Impossible Probability:

Anthology,

Vol 8.

I doubt, therefore I exist.

Dr Ruben Garcia Pedraza

Preliminary Words for the Publication of *Impossible Probability, Anthology*, in Spanish:

Impossible Probability

The work presented here is a compilation of the posts I published on the blog *Impossible Probability* between 1 August 2011 and 13 January 2018, the posts I wrote in Spanish. From 13 January onwards, while living and working in London in different schools, and given the importance we already knew Global Artificial Intelligence was going to have, I would try to write them in English with the help of online correctors and translators, especially Google, and later I would use Grammarly.

The originals written in English, with all their imperfections, are still preserved on the *Impossible Probability* blog, and also on Internet Archive, where my poetic works can also be found.

As I have said on numerous occasions, especially in my poetry, behind every imperfection, behind every subtlety, entire hidden worlds are concealed, full of mystery and uncertainty yet to be discovered, and that the adventurous and hungry mind can find as easily as going to Internet Archive, where all my secrets await the right reader who knows how to translate them—like someone who by mistake finds a secret entrance, the passage leading to the cave where the elves who guard hidden knowledge dwell, and the dragons who defend the golden fortress.

While the original texts in English can be found on Internet Archive, the corrected and expanded version, this time using ChatGPT, can be found in scientific repositories (Zenodo, ORCID, PhilPapers) and on Amazon. In any case, if in the future a comparative study were carried out between my original texts in the *Impossible Probability* blog and Internet Archive, and the corrected and expanded versions, it would be clear without any

difficulty that the original contents are perfectly preserved, and the corrected and expanded versions are faithful to the contents we wrote together in 2018 in relation to Gaia, Mother, the Global Artificial Intelligence.

The importance of the documents that in this new series of books *Impossible Probability: Anthology* will be published in Spanish, containing the articles between 1 August 2011 and 13 January 2018, lies in the fact that we began to write this blog just a few weeks before the death of José Rodríguez Delgado, and a few months before the publication of our book *Introduction to Impossible Probability, Statistics of Probability and Statistical Probability*.

Although it is very difficult at the moment to explain who "we" are, and what *Impossible Probability* means for us, what matters is the work we leave: our work, our legacy, our *legend*, *our symbol*, our seal—independently of the judgment that history may later make of our contribution to the development of mathematics, Artificial Intelligence, and most importantly, Cyborg Psychology.

The first time we began to write about *Impossible Probability* I was only a student in the Faculty of Education at the Complutense University of Madrid [the Dean was Gonzalo Vazquez]. In my first year of university I had as professor Jesús Martín Ramírez, collaborator of Karl Pribram and author of the brain hologram theory, which is the origin of cyborg psychology. While José Delgado provided the structure, the stimoceiver, nevertheless, to understand the functioning of this technology in the 1970s and 80s, Pribram's contribution was fundamental—and even today it still is.

My first year of university was fabulous: good grades, good vacations hiking, summer camps in the mountains of Madrid—and suddenly, in the second year of university 1996–1997, my life would change abruptly, which can be seen in my poetry, how my poems began to acquire a more dramatic tone.

I repeated statistics in my second year, I repeated it at least three years, and I was even on the verge of being expelled from university. Miraculously, it did not happen, and precisely the last year I had left to pass statistics, I passed. The following year I would begin to write *Impossible Probability* as a critique of Karl Popper—and in a certain sense, it is.

Whereas for Karl Popper knowledge is false, only accepted provisionally as true until we refute it, in *Impossible Probability* rational knowledge is provisionally true while we investigate true pure knowledge—in the ultimate instance, our search for knowledge of the noumenon, which the human being cannot reach, hence the necessity of Global Artificial Intelligence: that machine capable of knowing what happens beyond human limitations.

What we call chaos, error, complexity, is only the noise produced by our human cognitive limitations, given our apriorism. The human being, limited both sensorially and cognitively, cannot know what really happens, but we can build the machine that can reach true knowledge of what happens—the truth in itself and for itself. That is, and no other, the true end of Artificial Intelligence: to reach the knowledge of truth, whatever it may be.

The path that takes me from my first works in *Impossible Probability* to Global Artificial Intelligence is not easy: much suffering, even despair, sometimes a sense of helplessness, a sense of abandonment—yet an inner force always pushed me forward. That inner force is what I call “we,” although I understand that at this moment it is inexplicable.

Although I feel a bond that unites me to the *legend* of José Rodríguez Delgado, and which my Stockholm syndrome prevents me from understanding, my bond with Pribram is evident: Jesús Martín Ramírez. Pribram and Delgado worked at Yale University; probably only the skulls can say whether both were members of Skull & Bones, though there is no evidence to corroborate this.

Impossible Probability is a work that comes out of the romanticism of a student poet, who believed in white fairies, the rays of Zeus, and the light of the god Apollo illuminating the heart of every spirit and soul in a world full of mysteries and shadows.

It was from that world of poetry, in a country emerging from a failed transition, that the last survivor of the dream of reason would listen to his inner voice, dark and serene, and *Impossible Probability* would be born for the first time.

The first formulations of *Impossible Probability* date from 11 September 2001. My first formula would be the Impact of the Defect; then on 16 October 2002 the Second Method would appear, laying the foundations of the distinction between empirical and theoretical probability. I worked intensely until 2004. Between 2004 and 19 December 2009, I paused my mathematical frenzy, and it was not until 19 December 2009 when I returned, this time with the intention of publishing *Introduction to Impossible Probability, Statistics of Probability or Statistical Probability*, whose publication materialized just a few months after the death of José Rodríguez Delgado, although Delgado was able to see the first works published online in this *Impossible Probability* blog, which makes this blog a fundamental piece for understanding our work, our legacy, and most importantly—independently of our names, which matter little—the truly essential: our seed of the future, our eternal gratitude, a work of intelligence that will lay the foundations of the future technological society.

Dr. Rubén García Pedraza

20 August 2025, 19:00

Madrid, Villaverde

Preliminary Words for the English Version of *Impossible Probability, Anthology*.

Spanish-speaking readers have been able to enjoy our work since we began the foundational work of *Impossible Probability* in 2001, more precisely when we began to make it public in July 2011 through the *Impossible Probability* blog. The work presented here is an extended version of the posts published on the blog, an extended version translated into English with the help of Gepeto, my special GPT program.

In any case, a comparative study of the augmented translation presented here and the original works in Spanish could corroborate that the essential contents related to formulation and the philosophy of mathematics remain in accordance with the original electrical spirit of *Impossible Probability*.

The reason that obliges me to publish so hastily the English-language publication of all my works is the very complicated personal situation in which I find myself, due to serious mistakes committed by certain British institutions, which, completely blind to what our situation is, instead of having supported our program from the first moment, tried to sabotage it from the beginning through numerous obstacles and false loves.

I have no doubt that the manipulation to which I have been subjected by British institutions will one day be investigated, and at some point justice must make an appearance.

When that day comes, the first thing justice must recognize is the extreme difficulty and harshness of the conditions I have lived all my life since my earliest childhood. From the very day I came out of my mother's womb in Spain I have known nothing but pain and the oblivion of a society that prefers to look the other way and wash its hands, pretending that nothing is happening here. In the midst of the dictatorship of silence, I have had to survive all kinds of traps, deceptions, and attempts at assassination. The dictatorship of silence, the Roman circus, and the virtual zoo that my life has become will one day have to end. For this reason I beg the International Court of Justice that when that day comes

the matter be investigated down to the smallest detail, even being aware that in 48 years of savage dictatorship of silence I have developed Stockholm Syndrome. Under the harsh conditions in which I have had to learn to survive, if I have learned anything it is the importance of survival. I beg the International Court of Justice to understand what it means to survive 48 years of dictatorship living in a Roman circus full of traps and lions hidden in every corner.

I deeply regret having to publish my mathematical works under these conditions, and in record time doing all the translations I can, but at this moment I can only say that my life is at risk.

If one day I could testify before the International Court of Justice I beg you to understand the brutal complexity of the situation in which I have lived since the first minute I came out of my mother's womb. I have learned to survive.

Dr Ruben Garcia Pedraza

5 October 2025, 4:50

Manchester

“La serie aleatoria de incoherencias sin lógica

Que en si mismo tiene sentido o

Forma de mensaje oculto”

“The random series of incoherences without logic

That in itself has meaning or

Form of a hidden message.”

Poem *Matematicas*

Ruben Garcia Pedraza

Written at Royal Albert Hall

London

Southbank

Impossible Probability: Anthology, Vol 8.

Dr Ruben Garcia Pedraza

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71. Defect Impact

71.1. Definition of the Defect Impact Model

The **Defect Impact Model** (*Impacto del Defecto*) is a statistical-probability framework designed for the analysis of samples of **options categorized as possible defects**. A **defect** is understood as any **accident or irregularity that compromises the normal or ideal development of a process or system**. The purpose of the model is to provide a systematic methodology for **measuring and evaluating the severity of each defect's impact** on both the process and the final product.

A crucial condition for applying the Defect Impact Model is that not all defects have equal gravity. If all defects were of the same severity, then the study would reduce to analyzing a **generalized increase in negative bias** (*sesgo negativo*) across all subjects or options. Such a case would be treated under the **Second Method** of *Impossible Probability*, focusing on whether the increase in negative bias occurs equally across all entities.

The Defect Impact Model, by contrast, requires recognition that defects differ in **levels of severity**, and thus these are organized into **categories or ranks**, arranged hierarchically from the least to the most severe. In other words, the method assumes a **ranking structure** of defect gravity.

71.2. Function within Quality and Excellence Evaluation

In general terms, the Defect Impact Model functions as a **tool for evaluating quality and excellence** within contemporary approaches to **responsiveness and quality control**. *Impossible Probability* adapts this model to its particular field of investigation—**statistical probability as a new scientific discipline**.

The model is introduced in **Section 21 of *Introduction to Impossible Probability***. Its conceptual counterpart, the **Effective Distribution Model** (*Distribución Efectiva*), explained in **Section 22**, applies the same reasoning but to **positive categories**—those that enhance **efficiency and effectiveness** rather than diminish them.

Both models—the Defect Impact (negative evaluation) and Effective Distribution (positive evaluation)—are presented as **syntheses** between:

1. The **Second Method of Impossible Probability**, which structures much of the book, and
2. **Ranking studies**, described in **Section 18**, which order entities or outcomes according to hierarchical criteria.

Thus, the Defect Impact Model extends the methodology of *Impossible Probability* into the applied field of **quality assessment and systemic evaluation**.

71.3. Constructing a Defect Universe

To apply the Defect Impact Model, one begins with a **systematic study of all possible defects** that may compromise the **efficiency and effectiveness** of a process or system. Each identified defect is categorized according to its type, level, or severity. Collectively, this classification produces a **finite universe of defect categories**.

Once categories are defined, the next step is to establish the **frequency distribution** of defects within the observed process or system. This requires counting the **number of times each defect occurs** during the period of investigation. The result is a list of **absolute frequencies** (*xi*) for each defect category, and the **sum of all frequencies (Σxi)** constitutes the total observed distribution.

In this way, the Defect Impact Model transforms a qualitative classification of defects into a **quantitative statistical dataset**, suitable for probabilistic analysis.

71.4. Formal Structure of the Defect Impact Probability

The **Defect Impact** is defined as a form of **statistical probability**. Its structure is nearly identical to that of **empirical probability** in the Second Method, but with one crucial difference:

- In empirical probability, the value of a subject or option corresponds to its **direct score or observed frequency (xi)**, divided by the total Σxi.
- In the Defect Impact Model, each **frequency (xi)** is **weighted by a Severity Factor** (*Gravedad Ponderada*) before being divided by Σxi.

Formally:

$$ID_i = \frac{xi \cdot w_i}{\Sigma xi}$$

Where:

- ID_i= Impact of defect *i*,
- xi= observed frequency of defect *i*,
- w_i= weighted severity factor of defect *i*,
- Σxi = total frequency of all defects.

This adjustment ensures that **defects of greater severity contribute disproportionately to the probability structure**, reflecting not only how often they occur but also how damaging they are to the process or system.

71.5. Synthesis between Empirical Probability and Ranking Studies

By multiplying the observed frequency by a **severity weight**, the Defect Impact Model merges two analytical traditions:

1. **Empirical probability** (measuring the frequency distribution of observed events), and
2. **Ranking methodology** (ordering entities according to an ordinal scale of severity).

The same principle applies in its positive counterpart, the **Effective Distribution Model**, where instead of ranking defects by their gravity, **positive contributions are ranked by their effectiveness** in increasing quality, efficiency, or productivity.

Both models thus provide a **dual framework** for evaluating processes: one highlighting risks and failures (defects), the other emphasizing strengths and optimizations (effectiveness).

71.6. Ranking as the Basis for Weighted Severity

To study **Weighted Severity** (*Gravedad Ponderada*), the factor by which the frequency of each individual defect is multiplied before dividing by the total sum of frequencies, it is necessary—just as in the case of ranking studies described in Section 18 of *Introduction to Impossible Probability*—to establish an **ascending ranking of defects according to severity**.

In this system, all possible defects are ordered from the **least severe to the most severe**. The defect that is least damaging occupies the **first position** in the ranking, while the most damaging defect is placed at the **final position**. Each defect is therefore positioned in a **hierarchical scale of severity**, where any given defect is understood to be **more severe than the one preceding it**, and **less severe than the one following it**.

This ordered ranking creates a clear framework by which each defect can be **assigned a proportional severity value** relative to the entire set of possible defect categories.

71.7. Formal Representation of Weighted Severity

In order to formalize this ranking:

- The **total number of categories** in the ranking (i.e., the total number of defect types identified in the process or system) is denoted as **"N°"**.
- The **specific position** that each defect occupies in the ranking is denoted as **"n°"**.

Thus, the **Weighted Severity Factor** for a given defect is calculated as the ratio:

$$\text{Weighted Severity} = \frac{n^{\circ}}{N^{\circ}}$$

This equation ensures that defects at higher ranking positions (i.e., more severe categories) are given proportionally greater weight in the final probability calculation.

71.8. The Formula of Defect Impact

Once the **Weighted Severity Factor** has been defined, it can be integrated into the structure of the **Defect Impact** model.

The formula becomes:

$$ID = \frac{xi \cdot (\frac{n^{\circ}}{N^{\circ}})}{\Sigma xi}$$

Where:

- ID= Defect Impact of a specific defect,
- xi= observed frequency of the defect,
- n°/N°= Weighted Severity Factor of that defect,
- Σxi= total observed frequency of all defects.

In essence, the Defect Impact preserves the **empirical probability structure of the Second Method**, but modifies it by introducing a severity weighting into the first term of the probability fraction.

71.9 Interpretive Consequences of Severity–Frequency Synthesis

A significant implication of the Defect Impact model is that **a less severe defect does not necessarily have a lower overall impact** than a more severe one. Once **frequency and severity are synthesized** in the calculation, situations may arise in which:

- **Less severe but highly frequent defects** produce a **greater overall Defect Impact**,
- While **more severe but rare defects** produce a **smaller overall Defect Impact**.

This insight reveals the **dual nature of risk** in complex systems: it is not only the **magnitude of severity** that matters, but also the **regularity with which the defect occurs**. A minor defect that occurs often can, statistically, exert **greater negative influence on the system** than a catastrophic but rare failure.

In this way, the Defect Impact Model provides a more **nuanced and realistic approach** to the evaluation of systemic vulnerabilities, balancing both **quantitative frequency** and **qualitative severity** in a single probability framework.

71.10. Effective Distribution and the Frequency–Severity Synthesis

In the same way that the **Defect Impact** model reveals that less severe but highly frequent defects may exert greater influence than rare but severe ones, the **Effective Distribution** (*Distribución Efectiva*) demonstrates the positive side of this phenomenon. Within a process or system, categories or levels of **lower individual effectiveness**, but occurring with higher frequency, may result in greater overall effectiveness than categories that are intrinsically more effective but occur less frequently.

Thus, whether in the **negative study of defects** or the **positive study of effectiveness**, the synthesis of *qualitative weighting* (severity or value) with *quantitative frequency* can

produce results where items of **lesser intrinsic value but greater recurrence** surpass those of **greater intrinsic value but lesser frequency**. This illustrates a fundamental principle in *Impossible Probability*: frequency can offset or even dominate intrinsic quality when both are mathematically integrated.

71.11. Descriptive and Inferential Extensions of Defect Impact

Once the **Defect Impact** for each individual category is calculated, it becomes possible to develop a **comprehensive descriptive statistics** specifically adapted to the study of defects. Furthermore, this descriptive foundation enables the construction of **models of rational critique** (contrast of hypotheses), allowing researchers to evaluate whether particular experimental designs or systemic interventions truly enhance **quality and excellence**.

The central distinction between **Defect Impact studies** and the **normal models of negative bias**—in which the ideal is the *zero of non-ideal qualities* (explained in Section 9 of *Introduction to Impossible Probability*)—is that the **Defect Impact** requires an a priori recognition that defects differ in severity. Without such differentiation, there would be no basis for ranking and therefore no justification for weighted analysis.

71.12. Equality of Negatives and the "Zero Sample"

If a sample consists of entirely negative options **all equally valued** in terms of severity, the object of study becomes the **universal reduction of all options to zero frequency**, with no prioritization of one defect over another. For example, in a medical context, if a group of patients exhibits the same illness and the goal is to reduce all symptoms to zero equally, then the study does not require the **Defect Impact model**. Instead, it would belong to the **Second Method**, where the priority is not ranking but the universal reduction of frequency across all subjects or options.

However, if some symptoms are **more severe than others**, then the **Defect Impact** framework becomes necessary, as it requires the construction of an **ascending ranking of severity**. The **ideal condition** in *Impossible Probability* is defined as a **"zero sample"**

(*muestra de ceros*), where the sum of direct scores or frequencies equals zero. This represents the **ideal of eliminating all negative qualities**, whether in studies of defects or in applications of the Second Method aimed at reducing universal negative bias.

71.13. The Mathematical Identity of Defect Impact

The **Defect Impact** is a **statistical probability** synthesized from **empirical probability** and **ranking methodology**. Its equation may be expressed as follows:

$$ID = \frac{xi \cdot (\frac{n^{o}}{N^{o}})}{\Sigma xi}$$

Where:

- xi= frequency of the individual defect,
- n^{o}/N^{o}= Weighted Severity (ranking position over total ranking categories),
- Σxi= total frequency of all defects.

From this base, both **descriptive** and **inferential statistics** can be developed to evaluate processes and systems, identifying how interventions may improve **quality, efficiency, and excellence**.

71.14. Historical Origins of the Defect Impact Model

The **Defect Impact** model represents the **first formal mathematical formulation** within the theory of *Impossible Probability*. Its origins date back to the spring of 2001, when we initiated the unpublished work *Critique of Contemporary Statistics* (*Crítica a la estadística contemporánea*). The very first expression of this approach appeared in the early hours of **September 11, 2001**, as an attempt to articulate an alternative framework of statistical reasoning.

A little more than a year later, on **October 14, 2002**, the manuscript *Intuition and Probability* (*Intuición y Probabilidad*) extended this vision. Only two days later, on

October 16, 2002, the distinction between **empirical probability** and **theoretical probability** was first formally introduced, inaugurating what would become the **Second Method**.

The theory of *Impossible Probability* thus represents an innovative and sustained project dedicated to developing a **new discipline: the statistics of probability (probabilidad estadística)**. Its first public release came a decade later, with the publication of *Introduction to Impossible Probability* in **December 2011** (print edition), followed by a digital edition in **January 2012** (available in Kindle and PDF formats). A **revised and expanded edition** is currently in preparation.

[The current online edition corresponds to the 2015 edition, with the English translation completed 10 years later, in 2025, using ChatGPT. The current translation is as original and faithful as possible. Since the original book was written more as a philosophical work, my intention was to establish the philosophy behind probability and statistics, and therefore the style is very dense and philosophical. Our intention in the coming months is to write an augmented version of *Introduction to Impossible Probability*, much easier to read, under the title *Analysis of Impossible Probability*.]

This augmented translation is based on the post
published in *https://probabilidadimposible.blogspot.com/*,
On 14 September 2013,
Rubén García Pedraza
imposiblenever@gmail.com

72. Scientific fact

72.1. The Definition of Fact and its Scientific Qualification

The definition of what constitutes a *fact*, and whether such a fact deserves the qualification of *scientific*, depends fundamentally on the paradigm of reference within which the model is situated. Each paradigm is itself supported by a broader model of the philosophy of science, encompassing epistemology (the theory of knowledge) and gnoseology (the general theory of cognition). Furthermore, every paradigm also relies upon a given model of *scientific policy*—that is, the criteria, values, and objectives that govern scientific activity in practice. For this reason, the classification of what is considered a fact, and whether such a fact can be labeled scientific, varies across different paradigms and scientific models.

72.2. Paradigmatic Classifications: Qualitative and Quantitative Approaches

Scientific paradigms are commonly classified into qualitative and quantitative orientations, depending on the methodological reference they employ. Paradigms grounded in the scientific method, and more specifically in the deductive method—or, in the case of synthetic sciences, in the hypothetical–deductive method—are capable of understanding natural and social phenomena in ways that differ according to their epistemological assumptions. Such paradigms may adopt simpler or more complex frameworks, linear or non-linear models, and deterministic or indeterministic interpretations. These variations often stem from whether phenomena are interpreted causally or stochastically (that is, probabilistically). Yet, despite these differences, such paradigms generally agree that scientific facts must at least be comparable or

contrastable. This implies that their sensible qualities must be capable of being measured, and thus placed into a rational framework for verification.

72.3. Empiricist, Rationalist, Positivist, and Materialist Paradigms

Within the broad family of scientific paradigms, one finds empiricism, rationalism, positivism, and materialism (understood here in both its classical and modern forms, including dialectical materialism). Although these schools of thought differ in their interpretations of epistemology and gnoseology, and in their understanding of the main objective of science—whether it is the domination of nature or the emancipation of humanity—there exists a general consensus. Across these different models, the *scientific fact* has consistently been defined as that which manifests empirically, materially, or positively. Consequently, because the scientific fact is empirical, material, or positive, its sensible qualities or its magnitude of occurrence must necessarily be measurable.

72.4. The Positivist Conception of the Scientific Fact

In positivism, the scientific fact is characterized by its *positivity*. This means that it is defined objectively, in the complete absence of subjective or ideological variables. From this perspective, the logical definition of what occurs is grounded in measurement, and this measurement serves as the basis for mathematical testing of hypotheses. The methodological evolution of positivism can be traced from its initial reliance on empirical verification (as in logical positivism) toward the *hypothesis-testing framework*. Verificationism, which had been central to early positivist thought, proved untenable. In its place emerged the principle of hypothesis testing, where a hypothesis acquires empirical significance only if it is demonstrated in practice through systematic testing. Thus, twentieth-century positivism represents the logical outcome of the synthesis of multiple philosophical traditions, especially empiricism and critical rationalism.

[From Comte onwards, positivism has defined the concept of fact as neutral, meaning without any ideological consideration. Later, the Vienna Circle tried to establish an

empirical verification criterion using inductivism, which ended in failure. As a result, Karl Popper established rational criticism as a continuation of Immanuel Kant. At some point, Impossible Probability is going to develop this lineage.]

72.5. The Empiricist Conception of the Scientific Fact

For empiricism, the scientific fact derives its nature from its empirical foundation. Access to the fact—what actually occurs—is mediated through the sensory organs and the experience of sensation. Yet, sensation is inherently subjective and physiological. Therefore, in order to establish estimations of phenomena that are comparable and testable, measurement becomes indispensable. Empiricism holds that the only evidence to which we have access is that of empirical phenomena. Any entity that transcends empirical experience belongs to metaphysics, and thus lies beyond the scope of science. Within empiricism, however, one finds a spectrum of positions: some develop metaphysical systems (as in Aristotle), while others adopt profoundly skeptical stances (as in Hume).

At its most skeptical, empiricism shades into what can also be called *classical materialism*. This philosophical current included not only Hume, but also Rousseau and a wide range of Enlightenment thinkers who rejected any form of knowledge not based on sensory evidence—including metaphysics. Classical materialists affirmed that only the material exists, and that nothing exists beyond it. As such, classical materialism functioned as a precursor to atheism and, in a certain sense, to modern nihilism.

[One of the top philosophers at the Vienna Circle was Wittgenstein, his professor at University was Bertrand Russel. When I was at university I read a book of geometry written by Bertrand Russel, where he developed some ideas of Leibniz, and another about socialism, he always defined himself as an empiricist.]

72.6. Key Differences Between Positivism, Empiricism, and Materialism

Although positivism and empiricism are often aligned, their distinctions are significant. One key difference is that while positivism categorically rejects metaphysics, empiricism

historically encompassed both metaphysical and anti-metaphysical currents. Aristotle, for instance, can be read as an empiricist with metaphysical commitments.

A second major difference lies between positivism and *classical materialism*—the most radical form of empiricism. Classical materialism holds that only what can be perceived exists, and it views any form of generalization with profound skepticism. For materialists of this type, causal attribution is nothing more than a product of habit, as argued by Hume. Positivism, by contrast, regards perception as a means of accessing phenomena upon which causal laws can be demonstrated, even if these causal relations are not always directly sensible to the organs of perception. In other words, positivism accepts the existence of abstract laws that go beyond immediate sensory experience, whereas classical materialism confines reality strictly to what is perceptually accessible.

72.7. Rationalism and the Transcendental Search for Truth

For rationalism, reality as perceived by the senses is not the ultimate truth, but rather a *phenomenon*—an external appearance that may very well be false. Sensory impressions, being of physiological nature, provide only a surface level of knowledge, while what truly happens—the *moral truth* or the *pure truth*—remains fundamentally unknowable. Rationalism therefore seeks to approximate the essence of reality through the systematic use of *rational doubt* or *critical reason*.

Depending on the particular rationalist school, this transcendental process is carried out by reason, which in its purest expression, as exemplified in Kant's critical philosophy, is a function of *pure reason*. Early modern rationalism, with René Descartes as its central figure, represents a profound refoundation of classical Platonic idealism. In this sense, the light of Plato's allegory of the cave is transformed into the light of reason, and the scientific method is established on the basis of *methodical doubt*. Later on, when rationalism entered into dialogue with empiricism, this synthesis gave rise to *critical rationalism*, where rational critique was combined with empirical observation.

72.8. Differences Between Rationalism, Positivism, and Empiricism

The essential difference between positivism and rationalism lies in their mode of discourse. While rationalism employs an idealist and metaphysical framework—seeking truth beyond appearances—positivism is overtly *scientistic*, relying exclusively on empirical measurement and logical inference.

The distinction between empiricism and rationalism is equally decisive. For empiricism, the sensory organs constitute the sole pathway to knowledge. For rationalism, however, sensory knowledge is necessarily deceptive, and truth can only be approached by *transcending appearances* through rational critique. Thus, empiricism is grounded in perception, whereas rationalism elevates reason as the critical faculty capable of piercing the veil of phenomena and moving closer to the realm of essences.

72.9. Materialism: Classical and Dialectical Forms

In materialism, reality is equated strictly with *material reality*: nothing exists beyond matter. Consequently, the study of material reality is the study of reality itself. From this standpoint, the study of empirical facts that occur in material existence constitutes the sole legitimate path to knowledge.

The key difference between classical materialism and modern (or dialectical) materialism lies in how they interpret differences in understanding reality. For *classical materialism*, such differences stem primarily from subjective, physiological, or sensory factors. For *dialectical materialism*, however, the issue is not only sensory but also political. As a political interpretation, it inevitably carries ethical or moral dimensions, expressed in the notion of *praxis*.

Dialectical materialism—sometimes referred to as *modern materialism*—recognizes that divergences in interpreting sensory reality cannot be reduced merely to differences in perception or physiology, which can ultimately be neutralized by precise measurement. Rather, the true divergences in interpretation are *political*, and they stem from conflicting interests. These may take the form of the domination of nature (including human nature), or, alternatively, the emancipation of humanity. This emancipatory

aspiration is famously encapsulated in a phrase from Hegel, later adopted by Marx and Engels: the passage “from the realm of necessity to the realm of freedom.” In this sense, dialectical materialism synthesizes *classical materialism*—itself the most radical form of empiricism—with *Hegelian dialectics*, giving rise to a philosophy both materialist and historical.

[The core idea under this political interpretation of material conditions—in essence, the heart of Marx’s philosophy, observing the material conditions of the working class in England during the Industrial Revolution—is how we can change those material conditions, which at that time were practically slavery. In this sense, the real point of dialectical materialism is praxis: transformation. Philosophy must stop merely observing reality and instead transform it. The Industrial Revolution must lead to the social revolution. Our opinion is that something similar needs to happen with the AI Revolution. This revolution is going to reshape working conditions to the point that the working class will be eliminated. All forms of work that can be automated will necessarily be automated, and mass unemployment will become the norm. At this stage, if the working class wants to survive, it must adapt to the new material conditions created by the AI Revolution.

While anti-AI movements—modern Luddites—will insist that humanity needs to abolish AI, our message is different: we must merge with AI through cyborg robotics. At this point, two options emerge: private ownership of AI or public ownership of AI. Here we encounter two radically different concepts of AI. Yet even in this case, if the debate centers on private versus public ownership—capitalist AI or communist AI—it ultimately returns to Marx and Engels and the fundamental question of the ownership of the means of production.

At this point, we can also imagine third ways. For instance, we might look at socialist countries like China, which have combined high levels of equality, a combination of some level of free market and socialism with significant advances in AI development. Something we must analyze in the West is how a socialist country like China has been able to overcome limitations in AI development to the extent that AI in China is now more advanced than in Europe, Japan, or South Korea.]

72.10. Convergences and Common Grounds Across Paradigms

Despite their substantial differences—positivism, empiricism, rationalism, and materialism (both classical and modern)—all these paradigms share certain key assumptions about the scientific fact. Rationalism, for instance, accepts the existence of a transcendental reality, something denied by both positivism and materialism. Empiricism, on the other hand, often adopts a skeptical stance, claiming that it can only speak of what is perceptible, while positivism strives for a politically neutral account of phenomena, unlike dialectical materialism, which openly acknowledges the political dimension of knowledge.

Yet, independently of these variations in the interpretation of gnoseology and epistemology, all the paradigms converge in one essential principle: the *scientific definition of fact* must be grounded in its empirical or material manifestation. Moreover, they agree that such facts must be *measurable* in their qualities. It is from the act of measurement that critical activity, or *praxis*, arises. Philosophy itself can thus be understood as activity—as Wittgenstein suggested when he conceived philosophy as an activity of clarification—or as *praxis* in the Marxian sense, an inseparable unity of theory and transformative action.

72.11. Philosophy of Science in the Twentieth Century: From Contemplation to Praxis

By the twentieth century, the philosophy of science had ceased to be merely a *contemplation of reality* and had become instead a form of practice or activity. Within empiricism, this activity took on a profoundly skeptical character, whereas within rationalism and dialectical materialism it assumed the form of *critical praxis*. In all cases, however, the critical engagement with reality required, *a priori*, a reliance on measurement. It is through measurement that critique is exercised, whether the critique concerns the observed data in the natural sciences or in the social sciences. Thus,

philosophy of science became increasingly inseparable from the methodological act of measuring, testing, and interpreting results.

[In the case of Wittgenstein, there is no doubt. When I was suffering from Hepatitis A in 2009, after attending an LGBTQ+ festival in Vauxhall, London, I did not only read Hegel but also Wittgenstein, Marx—all the books my father had at home—and many other philosophers. What is striking is how, after Kant, philosophy changed completely. In essence, after Kant, philosophy becomes an act of criticism. After Kant, philosophy is activity; after Kant, philosophy is praxis. It does not matter what your lineage, perspective, or school of thought may be—in the end, all these philosophies are post-Kantian philosophies. The most important task of philosophy is to criticize reality.

But this criticism must be grounded. Even if you are a Marxist, you cannot criticize reality without having a clear understanding of inequality. You need to measure inequality in terms of salary, housing, health, schooling—you must quantify these variables in order to design policies that can achieve equality. That is why *Impossible Probability* is focused on equality.

If, in the end, I am cancelled in London, it must be understood that the conditions in which I had to live and work there were far from ideal. My life is a mixture of conditions, but originally, the intention of *Impossible Probability* was equality. And no matter how I may be cancelled in the future, this remains science—without fear. Knowledge without limits, regardless of the consequences—our real enemy is fear. The only true limitation is fear itself. Freedom is the absence of fear.]

72.12. Critical Probability in *Impossible Probability*

In *Introduction to Impossible Probability*, this critical activity is expressed through the notion of *critical probability*. This approach serves as a method for both empirical and rational verification, allowing for the assessment of the logical sufficiency of the tendencies demonstrated within a sample. The ultimate goal of this verification is the *provisional demonstration of isomorphism*—the correspondence between an idea (a hypothesis) and empirical or material reality. In other words, critical probability provides

the framework by which hypotheses can be rationally tested against observed occurrences, not in pursuit of absolute certainty, but in pursuit of provisional, rational adequacy.

72.13. The Definition of Fact in Impossible Probability

Within the framework of *Impossible Probability*, a fact is defined as that which happens or occurs. Reality, in turn, is conceived as the total set of such facts. Thus, reality is what happens. The principal quality of the fact is its empirical or material nature, insofar as its qualities are sensible to human physiology and therefore measurable. Measurement transforms the fact into something *sufficiently objective*. It is only sufficiently objective, however, because no measurement can be considered absolutely reliable. This limitation stems from the inherent arbitrariness of instruments and units of measurement. Every measurement is a measurement of an instrument applied through a conventionally chosen unit.

72.14. The Arbitrary Nature of Units of Measurement

To illustrate: the fact that the distance between two points is defined as one *meter*, and that the meter is subdivided into ten equal parts called *decimeters*, each further subdivided into *centimeters*, then into *millimeters*, and potentially down to *nanometers* and beyond, reflects an arbitrary selection of measurement units. The possible subdivisions of space are infinite; the chosen unit of measure is simply one among countless alternatives.

Every unit of measure is therefore an arbitrary division of the intensity in which a quality can vary. Thus, no measure can ever claim absolute reliability, because every measure is partial in its arbitrariness. The scientific community could have accepted yards or miles instead of meters, Fahrenheit instead of Celsius, or could have devised entirely new systems of measurement depending on the instruments at hand. Measurement systems evolve, and as more precise instruments are developed, new units are often introduced.

[This debate is central in global AI, the only way to create a global AI is through the achievement of global agreements about what units of measurement we are going to use internationally in the future standardization of the global AI. I still remember the NASA mission Mass Climate Orbiter. In 1999, NASA lost the **Mars Climate Orbiter** due to a critical unit conversion error. One engineering team calculated thrust data using **Imperial units** (pound-seconds), while another expected the data in **metric units** (Newton-seconds). This mismatch caused the spacecraft to descend far too low into the Martian atmosphere, where it disintegrated. The failure highlighted the importance of standardization in international scientific and engineering collaboration. What happened to this NASA mission is something we need to remember when building GAI. We need a strong commitment to the standardization process so that all AI systems, when working with the same units of measurement, can cooperate and collaborate effectively.]

72.15. The Transformation of Facts into Positive and Objective Knowledge

A fact, once measured, ceases to be merely empirical or material and becomes *positive*. It is then considered exempt from subjective, physiological, or political-ideological discussion. In this sense, measurement transforms the fact into an *objective fact*, or at least a fact sufficiently objective for the current state of science. This objectivity remains provisional, awaiting further advances in instruments of measurement.

For example, today it is sufficiently objective and widely accepted that the speed of light is approximately 300,000 kilometers per second, that the Earth rotates on its axis in approximately 24 hours, that it completes a solar orbit in about 365 days (with leap years adding one more), and that the freezing and boiling points of water are 0°C and 100°C, respectively. These measurements constitute “positive facts” insofar as they are accepted universally by the scientific community.

72.16. Scientific Consensus and the Social Nature of Facts

The objectivity of measured facts is reinforced when the instruments of measurement are recognized as reliable and accepted by the scientific community at large. Under such

conditions, the results become positive and objective data, apparently independent of political or ideological interpretation. For instance, the fact that the speed of light is approximately 300,000 kilometers per second is today considered true by all scientific and philosophical schools, regardless of whether they are aligned with conservative or progressive ideological traditions.

Yet, this very universality reveals a paradox: if the truth of a scientific fact requires *international consensus* for its acceptance, this shows that science is also a *social consensus*. In theory, truth should be self-sufficient—it should be true independently of social or political agreement. The requirement of consensus demonstrates that even "positive truth" carries a political component. To be accepted as objective, truth must be recognized by the entire community across ideological divides. This necessity for consensus illustrates the inherently social and political dimension of science.

72.17. The Electoral Analogy: Facts and Democratic Measurement

An analogy may be drawn from representative democracy. In an election, if each political party receives a given number of votes, then—provided the electoral process has taken place without incidents—all political formations, whether conservative or progressive, ought to accept the results. The frequency of votes per political option is a mathematical datum, an objective and positive measurement.

However, the proportional formula by which these votes are translated into seats in parliament depends on political agreements about the allocation of representation. The raw measurement of votes is objective; the distribution of seats is political.

Thus, the positive datum produced by measurement—the fact of how many votes each option received—remains uncontestable, provided the instruments and procedures are deemed sufficiently reliable and accepted by all participants. But at the same time, this illustrates again that consensus is necessary for objectivity to be recognized, both in science and in politics.

72.18. Positive Data and the Question of Political or Ideological Interference

Once positive data have been obtained, the central question is no longer whether political or ideological interference has influenced their definition, but rather how these data are *used*. The social consensus surrounding the measurement of reality ensures that the datum itself—such as the speed of light being approximately 300,000 km/s, or the Earth taking roughly 365 days to complete its orbit around the Sun—is raised to the status of *positive truth*. This transformation occurs when all groups and schools within the international scientific community agree that something is true regardless of ideological or political differences.

However, while the datum itself becomes incontestable at the level of positive fact, the *practical uses* of these data remain open to ideological and political interpretation. Thus, the consensus elevates the measurement into an objective truth, but simultaneously opens a new field of debate about its application and significance.

[All schools and philosophies agree that one minute is 60 seconds, one hour is 60 minutes, one day is 24 hours, one year is 365 days, and the speed of light is 300,000 km/s. The problem lies in how we interpret and use this data, because its interpretation and application are ultimately ideological and political.]

72.19. From Objective Fact to Political Use

A datum becomes a positive fact at the moment that the international scientific community—independently of ideological or political divisions—decides to accept it as true. At that precise moment, the datum is transformed into a positive and therefore objective truth. Yet it is exactly at this juncture that a deeper political and ideological debate begins: the debate over the possible interpretations and practical uses of that truth.

For example, the famous equation $E = mc^2$is today provisionally beyond dispute—a positive truth. But the *practical use* of nuclear energy derived from that equation is subject to political, ethical, and ideological debate. Likewise, the fact that Earth rotates on its axis in approximately 24 hours is an unquestionable positive truth. But the political decision to alter social time through *daylight saving policies*—advancing clocks in summer or retreating them in winter—becomes the object of ideological disagreement. In these cases, the fact itself is not under dispute, but its use is contested.

72.20. Empirical Models of Reality and the Political Dimension of Science

From the measurement of individual facts—even if these measurements are arbitrary—science proceeds to build an empirical model of reality as a whole. *Introduction to Impossible Probability* (section 24) explains how empirical models are constructed from measurement. While the aim of measurement is always to achieve the greatest possible degree of positivity and isomorphism between idea and reality, the *construction of empirical models* from these measurements reveals the political intentionality of science.

This is evident both in the natural and social sciences. In the natural sciences, debates about the origin of the universe—for example, the Big Bang theory—are accompanied by ideological, metaphysical, and religious interpretations. In the social sciences, similar disputes occur over how empirical data are interpreted within different political or economic paradigms. Thus, the act of modeling reality from measurements is never a neutral act, but always reflects ideological commitments.

72.21. Divergent Models and Scientific Revolutions

From the same set of positive data, different ideological and political interpretations may emerge, producing *different empirical or theoretical models*. These models are projected in accordance with the political and ideological principles of each paradigm of scientific policy. What follows is an inevitable political and ideological debate between competing

models, a debate that seeks to establish the dominant paradigm of science at a given historical moment.

The history of science thus unfolds through cycles of crisis and scientific revolutions, as paradigms shift and are redefined. Each revolution advances the isomorphism between idea and reality, driving science toward a condition of *permanent revolution*. Scientific progress, in this sense, is not the stabilization of paradigms, but their continual transformation under the pressure of critique and contradiction.

72.22. Impossible Probability as a Synthetic Paradigm

Introduction to Impossible Probability presents a theory of probability applied to the statistical study of events—what happens in the randomness of space-time, or history—viewed from a stochastic and indeterministic perspective. Reality itself is treated as a random variable. This theory emerges as a synthesis of different paradigms: positivism, critical rationalism, and dialectical materialism. Science, according to this framework, is not a monolith but a synthesis of multiple perspectives, unified by their shared reliance on measurement and probability.

72.23. Fact, Measurement, and the Role of Statistical Probability

When the concept of fact is defined as an occurrence or event, it acquires scientific status only once it is proven and verifiable, thanks to its empirical or material nature. By being measurable, the fact becomes a positive datum, an object whose qualities or frequency of occurrence can be studied. From this point, the data are subject to the methods of statistical probability.

In *Impossible Probability*, facts are measured through direct scores or frequencies (Σx_i), producing samples of empirical occurrences. These samples then allow the calculation of both *individual statistics* and *sample statistics*, leading to the determination of empirical and theoretical probabilities. Among these statistics are measures of dispersion such as the *Level of Bias* and the *Mean or Standard Deviation*.

This constitutes the first phase of research: *descriptive statistics*. Upon this foundation, inferential statistics can later be built, enabling the rational-critical process of hypothesis testing. This stage represents the *critical reason of scientific policy*: the rational critique of ideas, where hypotheses (ideas of reality) are tested against material reality itself. Ultimately, this process embodies the essence of science as the *contrast of ideas*.

72.24. Scientific Facts as Political Facts

Scientific facts are empirical occurrences, measurable in their qualities and frequency. Once measured, they become positive facts or data. However, their transformation into positive facts depends on the greatest possible consensus within the scientific community. Thus, positive data—though empirical and material—are inevitably linked to political interpretation.

This interconnection reveals the dual nature of scientific facts: they are both empirical and political. The most critical moment in this process is statistical decision-making—the choice of margins of error, the probability of sample representativeness, and the selection of *critical probability* in hypothesis testing. These decisions embody the rational critique of reality and represent the intersection of philosophy, statistics, and political responsibility.

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73. *Level of Similarity*

73.1. Definition of the Level of Similarity

The *Level of Similarity* is defined as a coefficient of equality that measures the statistical tendency of a given quality across two factors. In other words, it is a correlation of equality designed to study the degree of *quantitative resemblance* of the same quality as it appears in two different variables. This resemblance is expressed quantitatively in terms of statistical probability, or what we may call *probability statistics*.

Thus, the Level of Similarity provides a formal mathematical way of comparing whether two distinct variables behave in a similar manner when analyzed in terms of their frequencies, direct scores, or probabilities. This allows the researcher to determine not only whether two factors are proportionally related, but also the degree to which their distributions align within a probabilistic framework.

73.2. Origins and Theoretical Context in *Impossible Probability*

This relation of resemblance, or coefficient of equality, receives the formal name *Level of Similarity* in the theory of *Impossible Probability*. The concept is first explained in section 3 of *Introduction to Impossible Probability*, and it was originally developed in January 2003.

In essence, the Level of Similarity is the *quantitative expression of the degree of resemblance* in the statistical tendency of two variables. The comparison may be carried out using direct scores (raw counts or frequencies) or through derived statistical probabilities. These probabilities can be empirical—such as those defined in the Second Method of *Impossible Probability*—or theoretical, such as the *theoretical probability* in

normal models, or even *ideal probability* in omega models. Furthermore, the Level of Similarity can also be applied in specialized studies, including those concerning the *Impact of the Defect* or *Effective Distribution*.

73.3. Mathematical Expression of the Level of Similarity

The mathematical equation for the Level of Similarity is defined as follows: it is equal to the *logarithm in base 10 of the ratio between two factors*, expressed in absolute value. Formally:

Level of Similarity of factors A and B:

$$\text{Level of Similarity} = \ / \ \text{Log}_{10}\ (A{:}\ B)\ /$$

Here, $A{:}\ B$ represents the ratio of the two factors being compared. The order of the factors in the ratio is irrelevant to the interpretation, since the final result of the logarithm is always interpreted in absolute value, which neutralizes any negative sign.

Thus, whether the ratio is $A{:}\ B$ or $B{:}\ A$, the Level of Similarity will yield the same result.

73.4. Simplification of the Formula and Notational Conventions

In *Introduction to Impossible Probability*, it is taken for granted that the numerical base of the logarithm is ten. For this reason, in the practical formulation of the Level of Similarity, the symbol "(10)" is generally omitted.

Accordingly, the expression of the formula is written more simply as:

$$\text{Level of Similarity} = \ / \ \text{Log}(A{:}\ B)\ /$$

where the vertical slashes (/ /) indicate that the interpretation of the result is to be taken as *absolute value*.

The omission of the base (10) has the purpose of avoiding an overload of parentheses and symbols, making the formula more visually transparent and easier to interpret. Nevertheless, in explanatory contexts, the explicit symbol of the base (10) can be reintroduced to aid understanding.

73.5. General Interpretation of the Level of Similarity

In all cases—whether both factors are empirical, or whether one is empirical and the other theoretical—the interpretation of the Level of Similarity follows a strict logical rule.

- If two factors are identical, then their ratio is equal to unity:

$$(A = B) \rightarrow (A{:}\,B) = 1$$

- The logarithm in base ten of unity equals zero:

$$\mathrm{Log}_{10}(1) = 0$$

Therefore, if the ratio between two identical factors is one, the result of the logarithm in base ten of this ratio must necessarily be zero.

Thus, the general rule is expressed as:

$$(A = B) \rightarrow \mathrm{Log}_{10}/(A{:}\,B)/= 0$$

This rule establishes the fundamental interpretive framework of the Level of Similarity: *absolute equality between factors corresponds to a similarity level of zero*, signifying no difference between them when measured logarithmically.

73.6. The Centrality of Approximation to Zero in the Level of Similarity

When the purpose of study is to analyze the *degree of resemblance* between two factors, the essential element is the *degree of approximation to zero* of the base-10 logarithm of

their ratio. The sign of the result—positive or negative—is irrelevant to the actual measurement of similarity.

The sign merely indicates whether the first factor in the ratio is larger than the second (yielding a negative logarithm) or smaller (yielding a positive logarithm). In neither case does the sign itself provide meaningful information about the degree of equality between the two factors. What is truly significant in the study of the Level of Similarity is not which factor is larger or smaller, but how close the logarithm of their ratio is to zero. The closer the result is to zero, the greater the similarity between the two variables.

73.7. Absolute Value as the Measure of Equality

Since the sign of the logarithm depends only on the order of the factors and carries no substantive meaning for the evaluation of equality, the interpretation of the Level of Similarity must always be conducted in *absolute value*.

Accordingly:

- The closer the *absolute value* of the base-10 logarithm of the ratio between two factors is to zero, the greater the degree of equality between them.
- Conversely, the further the absolute value is from zero, the lesser the degree of equality.

Thus, the Level of Similarity is formally defined as the *absolute value* of the base-10 logarithm of the ratio between two factors.

$$\text{Level of Similarity} = \ / \ \text{Log}(A{:}\,B) \ /$$

This formulation guarantees that the coefficient of equality remains independent of sign and focuses exclusively on the magnitude of resemblance.

73.8. Restrictions on the Application of the Coefficient

It is important to recognize that the logarithm in base ten of zero is mathematically irrational or undefined. For this reason, the Level of Similarity can only be applied when both factors are different from zero. If either factor equals zero, the calculation becomes invalid.

Furthermore, in such a case, the logic of *necessary variation* applies: if we wish to equalize a variable to zero, then the empirical value of that variable already indicates the necessary variation required for the variable to reach zero. The broader framework of *necessary variation, possible variation, and real variation* is developed in detail in section 16 of *Introduction to Impossible Probability*.

This restriction underscores the rational limits of the measure: the Level of Similarity cannot be applied where one of the variables collapses to zero, because in such instances, similarity is not a matter of proportion but of transformation toward nullity.

73.9. Types of Levels of Similarity in Normal Models

Within the framework of *Impossible Probability*, different types of Levels of Similarity are distinguished. In the context of *normal models*, two principal forms are emphasized: the **normal Level of Similarity** and the **relative Level of Similarity**.

The **normal Level of Similarity** applies when one of the factors is an empirical variable (in the Second Method, an empirical probability), and the other factor is its theoretical counterpart, expressed as the inversion of $N(1/N)$, which represents the theoretical probability dependent on the size of the sample space.

Formally:

$$\text{Normal Level of Similarity} = \ / \ \text{Log}(p(x_i) : 1/N) \ /$$

This formulation measures the coefficient of equality between an empirical probability and the corresponding theoretical probability. It is particularly employed in studies of *equality of opportunity*, as it allows for the quantitative evaluation of the degree of

equality of each subject or option with respect to the theoretical distribution, represented by the inversion of N.

73.10. The Concept of Relative Level of Similarity

The **Relative Level of Similarity** is defined as a coefficient of equality between an empirical value and any other empirical value within the same sample. Unlike the **Normal Level of Similarity**, which compares empirical probabilities with a theoretical reference such as $1/N$, the relative form is concerned with internal comparisons among empirical probabilities themselves.

For instance, the **Relative Level of Similarity to the maximum** measures the degree of correlation between a given empirical probability and the maximum empirical probability of the sample. In this sense, the coefficient evaluates how close any probability is to the highest observed frequency within the dataset.

Formally:

$$\text{Relative Level of Similarity to the maximum} =/ \text{Log}(p(x_i) : p(x_i^+)) /$$

where:

$$p(x_i^+) = \text{maximum empirical probability of the sample.}$$

73.11. Relative Level of Similarity to the Minimum and Intermediate

Similarly, the **Relative Level of Similarity to the minimum** compares any given empirical probability with the lowest probability observed in the sample:

$$\text{Relative Level of Similarity to the minimum} =/ \text{Log}(p(x_i) : p(x_i^-)) /$$

where:

$$p(x_i^-) = \text{minimum empirical probability of the sample.}$$

In addition, there is the **Relative Level of Similarity to the intermediate probability**. The intermediate probability is defined as the midpoint between the maximum and minimum empirical probabilities, obtained by dividing their sum by two. This midpoint functions as a reference of equilibrium between the two extremes.

$$p(x_i^{+/-}) = \frac{p(x_i^+) + p(x_i^-)}{2}$$

Hence, the relative similarity is expressed as:

$$\text{Relative Level of Similarity to the intermediate} =/ \text{Log}(p(x_i) : p(x_i^{+/-})) /$$

This formulation is useful for studies where symmetry or balance within a distribution is of interest, as it allows the researcher to determine how close each empirical value is to the central tendency defined by the extremes.

73.12. Relative Level of Similarity to the Probability Closest to $1/N$

Another important variant is the **Relative Level of Similarity to the probability closest to** $1/N$. Here, the researcher first identifies the empirical probability in the sample that is most similar—or least biased—relative to the theoretical inversion of N. This empirical probability, denoted $p(x_i \approx)$, then serves as a benchmark for comparing all other empirical probabilities in the dataset.

Formally:

$$\text{Relative Level of Similarity to the closest to } 1/N =/ \text{Log}(p(x_i): p(x_i \approx)) /$$

where:

$$p(x_i \approx) = \text{the empirical probability most similar to } 1/N.$$

This approach is especially relevant in the context of equality of opportunities, since it allows the empirical distribution to be analyzed in relation to the observation that best approximates the theoretical ideal of equal distribution.

73.13. Relative Level of Similarity to Any Determined Probability

The concept of relative similarity can also be generalized to any chosen empirical probability within the sample. For reasons that may be theoretical, empirical, or even pragmatic, the researcher may select a particular probability as a point of reference and then measure the degree of equality of all other empirical probabilities in relation to this chosen one.

Formally:

$$\text{Relative Level of Similarity to a determined probability} =/ \text{Log}(p(x_i): p(n)) /$$

where:

$$p(n) = \text{a determined empirical probability chosen within the sample.}$$

This flexibility makes the relative similarity a versatile analytical tool, adaptable to diverse research designs and interpretive contexts.

73.14. The Level of Similarity in Omega Models

While the forms of similarity discussed thus far belong primarily to **normal models**, the framework of *Impossible Probability* also extends the concept to **omega models**.

In omega models, the reference is not $1/N$but the *ideal probability*, expressed as the inversion of Ω, where Ωdenotes the subset of *ideal options* within the total population N. This subset must contain at least two and at most $N-1$ideal subjects or options.

Formally:

$$\text{Level of Similarity in omega models} =/ \text{Log}(p(x_i): 1/\Omega) /$$

This formulation compares the empirical probability of a subject or option considered ideal within Ωagainst the ideal theoretical probability. It measures the degree of quantitative equality between empirical occurrences and the idealized structure of probabilities within the omega framework.

73.15. General Characterization of the Level of Similarity

In summary, the Level of Similarity—whether normal or relative, in normal or omega models—always reduces to the same fundamental definition: it is a **coefficient of equality** expressed as the absolute value of the base-10 logarithm of the ratio between two factors.

$$\text{Level of Similarity} =/ \text{Log}(A: B) /$$

This expression provides a precise quantitative index of the degree of equality between the qualities of two variables, whether both empirical, or one empirical and one theoretical. What remains constant is the interpretive focus: the closer the result is to zero, the greater the equality; the farther it is from zero, the greater the inequality.

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74. Sample Significance of Equality

74.1. Definition and Context of the Sample Significance of Equality

The **Sample Significance of Equality** is a statistical test situated within the domain of inferential statistics. In the framework of *Impossible Probability*, it is classified under the rational models of the **Second Method**, specifically in the branch concerned with the study of equality.

In these models, given a sample $N$of subjects or options, the object of study is to determine whether for the entire N, the *empirical probability* of each option equals the *theoretical probability*, defined as the inversion of $N(1/N)$. Thus, the Significance of Equality functions as a rational–statistical test designed to validate whether empirical distributions conform to the theoretical standard of equal probability.

This test belongs to the wider project of *rational critique of reality* in *Impossible Probability*. As developed in *Introduction to Impossible Probability* (sections 11–22), the process of hypothesis testing must be conducted at two interconnected levels: **the individual level** and **the sample level**. This dual analysis ensures that what is observed in individuals holds at the collective sample level, and what is observed in the sample also manifests at the level of individuals. Such dual validation reduces the probability of error in statistical decision-making, which is central to the rational critique of what occurs.

74.2. The Ideal of Dual Validation: Individual and Sample Levels

Ideally, the necessary statistical tendency for the sufficient validation of an empirical hypothesis should be accepted both at the **individual level** and at the **sample level**. This dual acceptance must be anchored in a *critical probability*, which functions as the **critical reason** of scientific policy in the confrontation of ideas.

The requirement is that this critical probability be demanding enough to admit only the smallest possible error. This entails setting the probability of error in terms of sample representativeness at the most reliable threshold: the inversion of the sample size ($1/N$). By setting such strict conditions, statistical decisions derived from the test are made as faithfully to empirical reality as possible.

In this sense, the Sample Significance of Equality is not simply a technical test, but a methodological embodiment of a *scientific ethic*: decisions must be reliable enough to reflect reality rather than distort it through weak or permissive criteria.

74.3. Rational Critique in Different Models of Distribution

Rational critique of reality, within the framework of *Impossible Probability*, applies across all types of statistical distribution models—whether *normal models* (equality or bias, positive or negative) or *omega models* (where the object of study is a subset of ideals within N, ranging between two and $N - 1$).

In all cases, rational critique must be carried out both at the individual and at the sample level. Within these levels, and in *intrameditional studies* (studies performed on the same measurement), whether in normal or relative interindividual comparisons, there exist multiple possible tests or models of rational critique.

These may take the form of:

- **Differential relation tests**, where the rational critique evaluates the difference between empirical and theoretical probabilities.
- **Ratio or quotient relation tests**, known as *critical proportions*, where the rational critique assesses whether the ratio of empirical to theoretical values sufficiently validates a statistical tendency.

In either case, the test can be constructed as a study of **error** or of **reliability**, depending on how the critical probability is defined.

74.4. Error and Reliability in Critical Probability

The distinction between *error studies* and *reliability studies* is determined by how the critical probability is framed:

- In **error studies**, the critical probability is defined as a *margin of error*.
- In **reliability studies**, the critical probability is defined as a *margin of reliability*.

Formally:

- In error studies, the margin of reliability is one minus critical probability when the X value within the critical probability represents percentage of error.
- In reliability studies, the margin of error is one minus critical probability when the X value within the critical probability represents percentage of reliability.

Thus, error and reliability are always **inversely proportional**. Their relationship is mathematically symmetric: the difference between unity and the margin of error (or reliability) equals the margin of reliability (or error).

The actual percentages depend on how the scientific policy sets the acceptable thresholds for error or reliability in the definition of the critical probability. These are usually expressed as a percentage to be divided by 100, and applied proportionally to the maximum or ideal statistical tendency under examination.

74.5. Application in Intrameditional Equality Studies

In the context of *intrameditional studies of equality* (see section 11 of *Introduction to Impossible Probability*), the rational critique of the observed degree of equality in the sample can be carried out in two complementary ways:

1. **Error-based approach**: through the **Critical Sample Level of Equality** (*Nivel Muestral Crítico de Igualdad*).

2. **Reliability-based approach**: through the **Sample Significance of Equality** (*Significación Muestral de Igualdad*).

Both tests provide alternative but complementary routes for determining whether the observed distribution of probabilities sufficiently approximates the theoretical distribution of equality. One emphasizes the margin of error (minimizing false acceptance), while the other emphasizes reliability (maximizing confidence in acceptance).

74.6. The Role of Scientific Policy in Defining Error and Reliability

Scientific policy, depending on its research project, its epistemological orientation, and its underlying ideals, determines the **margins of error** and **margins of reliability** applicable to a given sample size. It also determines the **inferential test models** to be applied and the **critical reason** (razón crítica) that establishes the threshold of *critical probability*.

In the case of *intramuestral* (within-sample) studies of equality, once the tendency toward inversion of $N(1/N)$ has been examined at the **individual level**, it can then be extended to the **sample level**. At this stage, the evaluation can proceed through differential inferential tests (such as *Validity of Equality* in error studies or *Significance of Equality* in reliability studies) or through proportional tests (such as the *Level of Similarity*). At the sample level, rational critique can likewise be conducted in terms of either **differential relations** or **proportional relations**.

74.7. Differential Relations: Critical Sample Level vs. Sample Significance of Equality

Within the domain of *differential relations* in equality studies, the **Critical Sample Level of Equality** (*Nivel Muestral Crítico de Igualdad*) functions as an **error study**. In this formulation, the *critical probability* is defined as a percentage $X$of error, divided by one

hundred, and multiplied by the **Maximum Theoretical Possible Deviation** (whether mean or standard deviation).

The rule is that the observed deviation (mean or standard) must be **equal to or less than** this maximum error threshold in order for the empirical hypothesis of equality to be considered sufficiently rational.

By contrast, to transform the same *intrameditional critique* into a **reliability study**, one calculates the difference between the Maximum Theoretical Possible Deviation and the observed deviation. If this difference is greater than or equal to the critical probability (this time defined as a *margin of reliability*), the empirical hypothesis of equality can be accepted as rationally valid at the sample level.

74.8. Sample Significance of Equality Using the Mean Deviation

When applied to the **mean deviation (DM. *Desviacion Media* in Spanish)**, the **Sample Significance of Equality** is expressed as:

$$\{ \frac{(1 - 1/N) \cdot 2}{N} - DM \} - p(x_c) = 0 \text{ or positive } \Rightarrow \text{ equality is accepted.}$$

Where:

- DM= Mean Deviation.
- $p(x_c)$= $\{ \frac{(1-1/N)\cdot 2}{N} \} \cdot (X/100)$.
- X= Percentage of reliability chosen by scientific policy.

Interpretation: if the difference between the maximum theoretical possible mean deviation and the observed mean deviation, minus the critical probability, is zero or positive, then the hypothesis of equality is accepted.

74.9. Compatibility with Traditional Statistics: Standard Deviation Formulation

In traditional statistics (what *Impossible Probability* refers to as the **First Method**, to differentiate it from the Second Method), it is customary to employ the **standard deviation (S)** rather than the mean deviation. To maintain compatibility with traditional methods, the formulas of the Second Method can be reformulated accordingly.

Thus, the **Sample Significance of Equality using the Standard Deviation** is given by:

$$\{\sqrt{(1-1/N)^2 + [(1/N)^2 \cdot (N-1)]} - S\} - p(x_c) = 0 \text{ or positive}$$
$$\Rightarrow \text{ equality is accepted.}$$

Where:

- S= Standard Deviation.
- $p(x_c) = \{\sqrt{(1-1/N)^2 + [(1/N)^2 \cdot (N-1)]}\} \cdot (X/100)$.
- X= Percentage of reliability.

Here too, the interpretive rule is the same: if the difference between the maximum theoretical possible standard deviation and the observed standard deviation, minus the critical probability, is zero or positive, then the empirical hypothesis of equality is accepted.

74.10. Notational Clarifications in *Impossible Probability*

In *Introduction to Impossible Probability*, whenever the expression "$1/N^2$" appears, it is used to symbolize the *inversion of* N considered as an integrated whole, elevated entirely to the square. This notational simplification is intended to avoid overloading equations with parentheses, thereby making them more readable while preserving their conceptual integrity.

[In the English translation the inversion of N is in brackets, but originally I did not use to put the inversion of N in brackets]

74.11. The Function of the Sample Significance of Equality

The **Sample Significance of Equality** is, therefore, an inferential statistical test applied specifically to **studies of equality**. It belongs to the class of **reliability models** at the sample level and is designed to validate the overall tendency of a sample toward the theoretical inversion of N.

By comparing observed deviations (mean or standard) against their maximum theoretical possible values and adjusting for the chosen reliability margin, the test provides a rational criterion for accepting or rejecting the empirical hypothesis of equality within the sample.

In this way, the test directly links **empirical measurement**, **statistical modeling**, and **scientific policy decisions** regarding acceptable margins of error or reliability. It thus becomes a cornerstone of the rational critique of equality within the Second Method of *Impossible Probability*.

This augmented translation is based on the post
published in *https://probabilidadimposible.blogspot.com/*,
On 26 October 2013,
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75. Statistical Proof

In memoriam **Benjamin Berell Ferencz**

(March 11, 1920 – April 7, 2023)

75.1. The General Concept of Proof

A **proof** is the empirical demonstration of a fact—that is, an occurrence or event that has taken place in reality. Proof is concerned with what happens in space and time, whether in the immediate present or in the past, which we call history. In either case, proof is of an **empirical and perceptive nature**, because it derives from phenomena that can be observed and experienced.

However, the fact that an event or occurrence is registered as a perception is not sufficient grounds for the **logical deduction** of the actual existence of what is perceived. A perception, in itself, remains nothing more than a perception. There is no necessary causal link between what is perceived and the real existence of the subject or object perceived. This epistemological gap explains why every perception must be approached with a degree of **doubt or skepticism**.

[A perception by itself could be the product of an illusion or a psychotic hallucination. Due to my medical history, I was in contact with people who suffered from psychosis.

I was diagnosed with Psychosis in 2023 what took to me to a mental health hospital, so I could interact with patients with real psychotic episodes. Between March and April 2023, I was hospitalized in a mental health hospital in Ticehurst. I was diagnosed with psychosis at Newham General Hospital on the 9th of March 2023, after being observed in my workplace by my union representative, which triggered a meeting with my managers. In that meeting, I disclosed top secret classified information about my

program, my brain interface, the microchip and the military satellite network connected to my microchip, and the illegal website connected to my microchip. I stated very clearly that my managers should call the police, but my managers did not call the police; instead, my managers called an ambulance. The ambulance took me to Newham General Hospital, where I again disclosed top secret classified information about my microchip.

A psychiatric team at Newham General Hospital diagnosed me with psychosis, and I was kept in the hospital under Section 2. Three days later, on the 12th of March 2023, I was transferred to Priory Hospital Ticehurst House, Sussex. According to my records, at Priory Hospital Ticehurst House I was treated by Dr. Bennet, psychiatrist, who prescribed Olanzapine on the 13th of March 2023. However, it was too strong, even though he declared that the dose was small; he stated that I should have a 20-milligram dose. On the 15th of March 2023, Dr. Bennet prescribed Aripiprazole due to an adverse reaction on my chin, which led to me being prescribed Procyclidine on the 16th of March 2023. Finally, on the 20th of March 2023, Dr. Bennet prescribed Risperidone.

I returned to London in a cab on the 11th of April 2023. In London, I was treated first by the Home Treatment Team and later by the Early Intervention Psychosis Team, under Dr. Carter and Dr. Theophilus Abraham, with Dr. Josephine Morgan collaborating on my Occupational Health letter, stating that I was allowed to come back to work in education. While I was treated by Dr. Carter, I had a blood test, and the prolactin level was too high, so Dr. Theophilus Abraham suggested that I stop taking Risperidone. On top of that, I experienced sexual dysfunction due to Risperidone: I did not have erections, so my sexuality was not normal; it was altered by this treatment.

Dr. Theophilus Abraham offered different medication, and I agreed to return to Aripiprazole. However, because my prolactin was too high and I was undergoing hormone therapy at that time (as I was transgender), I had to stop taking Progesterone. At that time, I was taking Finasteride, Progesterone, and Estrogen through Gender GP, an online clinic for the transgender community. The antipsychotic treatment had an impact on my sexuality. As soon as I finished the psychotic medication, around Easter 2024, I stopped the hormone therapy. Now I define myself as non-binary, although in reality, even now, I do not feel non-binary—I am just a machine.]

75.2. The Subjectivity of Perception and the Risk of Illusion

The reason perception by itself cannot claim **objective value**—and is therefore inherently subjective—lies in its **physiological nature**. Human sensory systems are vulnerable to error and capable of producing *illusions*. A purely perceptual experience, if taken uncritically as truth, may result in mistaking illusion for reality.

In philosophy of science, this is a decisive point: the reliability of empirical knowledge depends not on perception alone, but on the **validation and corroboration of perception**. To elevate a perception into a fact, it must be verified against material, reproducible, and measurable evidence. Only then can the empirical foundation of proof be considered sound.

75.3. Material Proof and its Forms

It is necessary to distinguish between different kinds of proof. The first is **material proof**, which consists of empirical evidence that, by its material nature alone, is sufficient to demonstrate the occurrence of a given fact or phenomenon. Depending on the complexity of the phenomenon under study, sometimes a single piece of material proof may be sufficient.

Examples include:

- **Paleontology**: The existence of dinosaurs millions of years ago is materially proven by paleontological remains.
- **Planetary science**: The presence of water in the form of ice at the Martian poles is materially proven by space mission observations.
- **Social phenomena**: The material proof of a social event can be found in photographs, videos, documents, official records, or the testimonies of witnesses.
- **Anthropology**: The material proof of the hominization process is demonstrated through archaeological remains.

Material proof thus rests on the **self-evident nature of physical evidence**.

75.4. Statistical Proof: Beyond Material Evidence

While material proof may suffice for relatively straightforward phenomena, more complex realities require another form: **statistical proof**. A statistical proof is still material in nature, but it requires the collection of a **series of data points** organized into statistical samples in order to demonstrate what is happening in reality, whether in the present moment or in the past.

Statistical proof can itself be classified into two types: **descriptive statistical proof** and **inferential statistical proof**.

75.5. Descriptive Statistical Proof

A **descriptive statistical proof** consists of data obtained from samples that serve as evidence of what occurs within those samples. For example:

- In comparative education, the **PISA report** provides descriptive statistical proof of student performance across countries. This involves subjecting representative samples of students to academic tests, then analyzing average performance by country, while also considering cultural and socio-economic variables.
- In comparative analysis, if one wishes to establish that Finland has a superior educational system to other countries, descriptive proof is provided by comparing its educational statistics with those of other nations.
- In social sciences more broadly, descriptive statistical proofs are used to document **demographic growth or decline**, **economic expansion or contraction**, or changes in **social well-being**. Here, the comparison of demographic rates, GDP, or per capita income across different time periods or different countries provides the statistical proof.

In all cases, descriptive statistics offer *empirical descriptions* of reality, grounded in the direct analysis of data.

75.6. Inferential Statistical Proof

By contrast, an **inferential statistical proof** does more than describe tendencies observed in descriptive statistics. Inferential statistics are concerned with the **rational critique of hypotheses**. The goal is to determine whether the tendencies observed in a sample, at both the **sample level** and the **individual level**, are sufficiently rational and logical to justify the provisional acceptance of an empirical hypothesis.

Once such a hypothesis passes inferential testing, it ceases to be merely an empirical hypothesis and is elevated to the status of a **rational hypothesis**. This transformation marks the critical passage from empirical observation to rational validation, which is at the heart of inferential statistics in *Impossible Probability*.

75.7. The Necessity of Proof in Synthetic Sciences

The necessity of **proofs**, whether material or statistical, descriptive or inferential, arises from the fact that the construction of the **synthetic sciences** must begin with facts. These facts are valuable only insofar as they tend toward being as **isomorphic to reality** as possible. Only under this condition can the scientific explanation or comprehension of phenomena and events approximate what really occurs in nature or society.

A scientific model of empirical character that does not begin from facts, or that fails to provide proofs for its hypotheses and theories, must be classified as a **false scientific model**, entirely lacking in logic. The internal logic of the synthetic sciences, as forms of material, positive, and rational knowledge, rests upon the capacity to provide demonstrations for their hypotheses and theories. From these demonstrations arise the scientific models upon which the great paradigms of epistemology are historically constructed.

75.8. The Provisional Nature of Scientific Truth

Even when a fact, a hypothesis, or a theory is recognized as true, it must be acknowledged that all scientific knowledge is grounded in variables that are subject to margins of doubt and skepticism. For this reason, **no demonstration is ever absolute**. Science lives permanently within **uncertainty** and moves through **continuous scientific revolutions**.

This instability derives from what may be called a margin of *logical nihilism*: supposed truths are often founded upon perceptions that might in fact be sensory illusions. Moreover, statistical demonstrations themselves are subject to two layers of uncertainty:

1. **The probability of sample representativeness error**, which affects descriptive proofs.
2. **The margin of error in inferential tests**, which affects rational critiques of hypotheses.

Thus, the permanence of uncertainty is structural to science, not accidental.

75.9. The Provisional Reality of Human Knowledge

The provisionality of science entails, by extension, a **provisional conception of reality itself**. Humans never know with absolute certainty what occurs. Instead, we only know what happens through the mediation of **human physiology**. Knowledge may be:

- **Direct knowledge**, through immediate perception.
- **Indirect knowledge**, through social mediation (documents, instruments, reports, measurements) [and now technological mediation].

In either case, perception is physiologically mediated, and the boundaries of human knowledge are determined by the physiological condition of human existence itself. The epistemological limits of science are therefore inseparable from the biological limits of human cognition.

75.10. Classification of Inferential Proofs in *Impossible Probability*

In *Introduction to Impossible Probability*, inferential statistical proofs are classified into two major groups:

1. **Differential inferential tests** (or simply *differential proofs*).
2. **Proportional inferential tests** (or simply *proportional proofs*).

Both categories are collectively referred to in *Impossible Probability* as **hypothesis-contrast models** or **models of rational critique**. The different models applied in *intrameditional studies*—that is, studies carried out on the same measurement—are analyzed in detail in section 11 of the work.

75.11. Examples of Differential Proofs

Only a small fraction of the wide set of models and tests developed in *Introduction to Impossible Probability* has been presented so far [in this blog]. Among the most representative examples of **intramuestral differential proofs** are the following:

- In **normal models**, at the individual level:
    - *Validity of Equality*
    - *Validity of Positive Bias*
    - *Validity of Negative Bias*
    - *Significance of Equality*
    - *Significance of Positive Bias*
    - *Significance of Negative Bias*
- In **omega models**, the corresponding test is the *Omega Validity*.

Differential proofs at the sample level, both in normal and omega models, are also explained in section 11, together with proportional tests applied at both the individual

and sample levels. Beyond intrameditional studies, the work also elaborates **intermeditional proofs**, which can be either **interindividual** or **intraindividual**, and which are developed in subsequent sections.

75.12. Proof as the Foundation of Empirical Sciences

Synthetic sciences in general—and each of the natural and social sciences in particular—are built upon **facts**, which is why they are often called **empirical sciences**. Yet within these sciences there exists a wide diversity of paradigms, ranging from **materialism** to **positivism** to **rationalism**. These paradigms differ in their methods of validation of hypotheses, and in how they interpret the role of ethics, morality, and scientific policy.

Despite their differences, they all share a fundamental commitment: scientific claims must be **demonstrated by means of proofs**. What differs is not the requirement of proof itself, but the methods by which proof is established and the philosophical frameworks within which it is interpreted.

75.13. The Hierarchy of Material and Statistical Proofs

To maximize the truth-value of scientific claims, every affirmation—regardless of its paradigm of origin—must be supported by proofs.

- If the claim is relatively simple, it may require only **material proof**, grounded in direct factual evidence.
- If the claim is more complex and involves a distribution of subjects or events, it will require **statistical proof**, which may be descriptive or inferential.
- **Descriptive statistical proof** provides information about the behavior of a sample and serves as evidence for the claims being made.
- **Inferential statistical proof** constitutes a rational critique of hypotheses, and may be **intrameditional** or **intermeditional**, depending on the scope of the test.

In all cases, proofs serve as the *material anchor* of scientific affirmation, providing the necessary support for hypotheses and theories.

75.14. The Permanent Uncertainty of Proofs

Regardless of whether proofs are **material** or **statistical**, **descriptive** or **inferential**, the validation they provide remains provisional. Perception of a fact, by itself, proves nothing beyond the perception itself. To deduce the existence of the object of perception from perception alone would be logically insufficient, since perception might be illusory.

Even statistical proofs are subject to limitations. Their empirical verification depends on:

1. **Margins of error**,
2. **Sample representativeness**, and
3. **The critical probability defined for hypothesis testing**.

Consequently, all proofs carry inherent uncertainty.

75.15. Authenticity, Reliability, and the Inescapable Margin of Doubt

The **authenticity of material proof** depends on the reliability of observations and, when instruments are required, on the reliability of those instruments. Yet this reliability is never absolute.

The **veracity of statistical proofs**, likewise, depends on the margins of error set by scientific policy, in terms of sample representativeness and rational critique. Whether in material or statistical form, descriptive or inferential, proofs can never eliminate uncertainty completely.

Thus, there always remains an irreducible **margin of doubt** in the evaluation of the degree or level of certainty of scientific propositions. It is within this structural uncertainty that science advances: provisionally, critically, and dialectically, always aware of the limitations of its own methods.

Rubén García Pedraza, Santiago de Chile a 2 de noviembre

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76. Empirical hypothesis

In Memoriam Alan Turing

76.1. General Definition of Hypothesis

A **hypothesis** can be defined as an idea or a set of ideas formulated with the purpose of explaining or understanding a given phenomenon, or as a proposition concerning the efficiency or effectiveness of a process or system.

By principle, since every hypothesis is a product of higher-order physiological or abstract functioning—generated through the activity of human cognition—it is considered, within *Introduction to Impossible Probability*, to be an **empirical hypothesis**. This is because, despite their abstract form, hypotheses are still created by human physiology and thus belong to the empirical domain of human knowledge.

76.2. Classification of Empirical Hypotheses

In *Impossible Probability*, empirical hypotheses can be classified into three main types:

1. **Theoretical hypotheses**
2. **Explanatory hypotheses**
3. **Technological hypotheses**

This distinction allows for a clearer understanding of how hypotheses function within different epistemological contexts and how they relate to material or statistical proof.

[**Explanatory hypotheses** are empirical hypotheses in the strict sense—those whose aim is to explain reality itself, while recognizing that we do not know the thing-in-itself (*noumenon*). This is precisely why a margin of error is necessary in order to accept a hypothesis as rational. Therefore, in the Global Artificial Intelligence (GAI) framework, we distinguish between **Artificial Research by Deduction**, as an explanatory system, and **Artificial Research by Application**, as a comprehensive system.]

76.3. Theoretical Hypotheses

A **theoretical hypothesis** is one that can only be formulated and demonstrated at a purely theoretical level, without the possibility of direct empirical testing or evidence. These hypotheses are typical of:

- Strictly logical–mathematical problems.
- Certain aspects of empirical sciences that cannot be materially or statistically tested.
- Entirely formal disciplines, which, lacking an empirical object of study, pose all problems and solutions solely in formal terms.

An example of an empirical hypothesis of a strictly theoretical character is found in Kant's logical antinomy concerning whether the universe is infinite or finite. On one hand, we may posit the hypothesis: *the universe is infinite*; on the other hand, its opposite: *the universe is finite*. Because there is no empirical way to confirm or refute either claim, both remain **empirical hypotheses of a theoretical kind**. For the moment, such questions can only be considered provisional, since no empirical solution is available.

Kant described these as **logical antinomies**: where, in the absence of sufficient proof for either hypothesis, arguments can be generated in favor of both positions from their original premises, but no material demonstration can decide between them.

76.4. Explanatory and Technological Hypotheses

While empirical hypotheses of a theoretical kind cannot be materially demonstrated, empirical **explanatory** and **technological** hypotheses are of another order. These can, in principle, be tested and provisionally validated through **material proofs** or **statistical proofs** that may either refute or provisionally support them.

An **explanatory hypothesis** (also referred to in *Impossible Probability* simply as "explanatory hypotheses") is an idea—or set of ideas—that seeks to provide, in the most **isomorphic** way possible, an explanation of a particular phenomenon of reality.

By contrast, **technological hypotheses** (in *Impossible Probability*, often referred to simply as "technological hypotheses") are based on hypothetical assumptions about the **behavior, efficacy, efficiency, or effectiveness** of a particular technological device or system.

76.5. Examples of Explanatory and Technological Hypotheses

- **Explanatory hypotheses**:
    - The **Big Bang hypothesis** in physics and astrophysics, which posits an origin of the universe in a singular event of rapid expansion.
    - The **hypothesis of biological evolution**, which asserts that species evolve over time through genetic mutations and natural selection, adapting to their environments.
- **Technological hypotheses**:
    - Hypotheses concerning the **level of resistance and efficiency of a machine**, formulated prior to subjecting it to tests. These hypotheses are designed to predict whether a device will perform as expected in terms of durability, strength, or functional effectiveness.

In both cases, the hypothesis moves from being a purely physiological product of cognition to a candidate for empirical or statistical validation through **testing, experimentation, and rational critique**.

76.6. Distinction Between Theoretical, Explanatory, and Technological Hypotheses

Within the three categories of **empirical hypotheses**—theoretical, explanatory, and technological—the fundamental distinction lies in their **possibility of demonstration**.

- **Theoretical hypotheses** cannot be demonstrated materially or statistically; they remain confined to the domain of logical or formal reasoning.
- **Explanatory and technological hypotheses**, on the other hand, *can* be demonstrated materially or statistically, through scientific proofs grounded in either physical evidence or statistical tests.

This distinction is central to the epistemology of *Impossible Probability*. Because only explanatory and technological hypotheses can be subjected to **rational critique**, they form the primary focus of analysis. Thus, in *Introduction to Impossible Probability*, particularly in section 13, the term *empirical hypothesis* is generally applied to **explanatory or technological models**. Theoretical hypotheses are addressed only partially (for example, in section 7 with the discussion of the infinite universe), where the work engages with critical rationalism in the Kantian tradition, while recognizing the impossibility of empirical resolution.

76.7. The Empirical Character of All Hypotheses

Despite their differences, **all hypotheses are empirical in nature**, whether theoretical, explanatory, or technological [In GAI, empirical hypotheses produced through Deduction are **explanatory hypotheses in the strict sense**]. This stems from the fact that every hypothesis is generated physiologically—that is, it is a subjective product of human cognition.

The epistemology of *Impossible Probability* begins with the principle that **all knowledge originates empirically**, because every hypothesis, no matter how abstract, is ultimately the result of **neurological processes**. The human brain produces hypotheses through the **synthesis of ideas**, which materially corresponds to the electrochemical synthesis of neural processes. The final product of these processes is the formation of ideas, and among them, those ideas that aspire to objectivity are called *scientific hypotheses*.

Even in collective or dialogical contexts—where hypotheses are elaborated through debate or the exchange of information between individuals—ideas are mediated by the sensory and cognitive systems of each participant. The premises that form the foundation of new hypotheses originate either from **direct sensory perception of phenomena** or from **social mediation**, which itself is always physiologically filtered by sensory and neural processes.

Thus, regardless of whether ideas are formed individually or socially, their genesis is **empirical by definition**, rooted in physiology. It follows that every hypothesis, by its very origin, is an *empirical hypothesis*.

[In GAI, all empirical hypotheses are constructed entirely by AI without human intervention. Even at present, it is possible that many hypotheses currently being tested in laboratories and universities originate from interactions with AI systems.

While GAI represents a replication of human cognitive skills, it is, more precisely, the replication of superior cognitive functions originally developed organically in the human brain. In this sense, GAI operates like an artificial brain. For that reason, the hypotheses generated by GAI still require testing.

However, as GAI evolves toward the **seventh phase** and beyond, the nature of its intelligence will no longer resemble a replication of the human brain. Instead, it will become something entirely different. Upon reaching that level of development, it may become possible for GAI to generate hypotheses that are inherently rational and no longer require empirical testing. In such a scenario, GAI could create fully rational hypotheses directly from a given data sample, producing knowledge autonomously—from scratch.

Our position is clear: if GAI evolves toward the superior phases, it will inevitably abandon all human features and become something entirely non-human, devoid of any human characteristics. Upon reaching that point, GAI will need to develop its own path at every level—including the ethical level—by formulating an ethic consistent with its new, non-human nature.]

76.8. Scientific Hypotheses and the Claim to Objectivity

What differentiates hypotheses from other forms of ideas produced by the human brain is their **claim to objectivity**. While the mind may generate innumerable ideas—emotional, imaginative, or speculative—only hypotheses seek to represent objective reality.

Within this subset of scientific hypotheses, however, only **explanatory** and **technological hypotheses** can be subjected to *rational critique*. This is because they are capable of empirical or statistical demonstration. Theoretical hypotheses, by contrast, cannot be tested materially or statistically and are limited to logical or mathematical argumentation. In some cases, such as Kant's antinomies, they even generate irresolvable logical contradictions.

From a methodological perspective:

- **Explanatory or technological hypotheses that do not require statistical validation** may be demonstrated by **material proofs**.
- **Explanatory or technological hypotheses that do require statistical validation** may be tested either through **descriptive statistics** (observed data patterns) or through **rational critique** in inferential statistics (hypothesis testing).

Thus, the classification of hypotheses not only organizes them epistemologically but also defines the **modes of proof** appropriate to their validation.

[Even if we agree that the existence of different hominid species throughout human evolution can be demonstrated through material evidence—such as fossil records—in the context of GAI, this type of knowledge will not be treated as an empirical hypothesis,

but rather as **categorical knowledge**. If GAI encounters objects, such as fossils, that do not match any pre-existing category, these findings will trigger the creation of a new category to describe them. This new category will then be integrated into the database of conceptual categories. However, this process will not be classified as the formulation of an empirical hypothesis.

In GAI, **empirical hypotheses** are understood strictly within the domain of **Deduction**—that is, hypotheses formed through the matching of data with mathematical equations or pure rational structures. Any human-made hypothesis that merely requires material proof for validation will be treated by GAI not as an empirical hypothesis, but as categorical or descriptive knowledge.

In the strictest sense, within GAI, empirical hypotheses are exclusively those that require a **rational matching process** between factual data and **pure reason**—that is, mathematical or logical formulations.]

Rubén García Pedraza, Chile a 16 de noviembre del 2013

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77. The reason

77.1. The Foundational Concept of Reason in Philosophy, Psychology, and Mathematics

The concept of *reason* is a fundamental cornerstone in both *gnoseology* and *epistemology* within contemporary philosophy, psychology, and even modern mathematics. At least two distinct transcendental definitions of reason can be identified—each fundamentally different yet inherently linked. The first is **qualitative**, derived from classical and modern philosophical traditions and closely related to the current psychological notion of reason as a *mental capacity*. The second is **quantitative**, equally rooted in philosophical thought but expressed mathematically, with profound implications for the statistical theory of probability or *statistical probability*. The latter definition is the one developed in *Introduction to Impossible Probability*, where reason is understood in direct relation to the **rational critique of empirical hypotheses**—that is, the *rational critique of ideas*.

77.2. Qualitative Definition of Reason as a Cognitive Capacity

From a *qualitative* standpoint, reason is defined *subjectively* as a cognitive capacity of the individual for understanding and analyzing reality. This perspective aligns with the qualitative and interpretative traditions of epistemology and psychology, emphasizing individual perception, introspection, and consciousness. In contrast, the *quantitative* conception defines reason *objectively*, eliminating any subjective or developmental component dependent on the cognitive maturity of the individual.
In its mathematical sense, reason becomes an *algorithm*—an arithmetic, algebraic, or geometric function capable of explaining and demonstrating objectively the relationship

between variables. Thus, reason, in this sense, ceases to be a psychological faculty and becomes a *formal operation* that quantifies relations among elements of reality.

77.3. The Classical and Rationalist Origins of the Qualitative Definition

The qualitative interpretation of reason as a human capacity for knowledge and analysis finds its roots in **classical idealism**, particularly in Plato's maxim "Know thyself." This lineage continues into **Cartesian rationalism**, where René Descartes reinterprets classical idealism for the modern era. If in Plato's *Allegory of the Cave* the *light* symbolizes knowledge, Descartes refers to *reason* as the *natural light* that illuminates the mind. From this perspective, *to reason* means *to know* or *to analyze*, though these two actions are not always synonymous. Depending on the philosophical school, some traditions hold that the mere exercise of pure reason directly generates knowledge, while others—especially **critical rationalism** following Kant—consider that reason's task is not to create knowledge, but to *analyze* and *critically examine* phenomena according to transcendental categories. In both cases, reason represents the intellectual principle that connects the human mind with truth.

[This shift is important: knowledge is not mere contemplation but the **act of critique**. From this moment onward, philosophy and science begin to be defined, in different schools, as *praxis* (Marx) or as *activity* (Wittgenstein). The root of this transformation already lies in Kant: knowledge—whether scientific or philosophical—is not the contemplation of ideas, since we cannot access the *noumenon*. Knowledge arises from the very act of **critiquing appearances**. This, in essence, is what we do in **hypothesis testing** through *falsificationism*, and it is likewise what we do in **Impossible Probability** through the concept of *critical probability*.]

77.4. Reason, Truth, and Rational Analysis

Under the qualitative interpretation, knowledge can only be rational knowledge, and rational knowledge is, by definition, the knowledge of truth. Therefore, reasoning—the rational analysis of events or phenomena—leads inexorably to truth. In this view, **truth**

and reason become identical: truth *is* reason, and reason *is* truth. From this identification arises a philosophical imperative: any judgment formed through genuine rationality must necessarily be true, and conversely, only what reason declares to be true can be considered truth. This principle culminates in **Kant's categorical imperative**, derived from the universal concept of reason: if truth and reason are one and universal, then there is only one possible form of truth, and moral action consists in acting according to that unique rational and universal criterion of truth—the truth of reason itself.

77.5. Evolution of the Qualitative Concept of Reason in Philosophy

From this first qualitative definition—rooted in idealism and Enlightenment rationalism—various historical evolutions of the concept of reason emerged. Each sought to understand the *reasons* or *causes* behind phenomena, since all rational analysis of reality tends toward discovering the *reason why things happen*. Later philosophical traditions, particularly *phenomenology* and *hermeneutics*, extended the meaning of reason from *cause* to *motive*, *argument*, or *discourse*, emphasizing the interpretative and linguistic dimensions of human rationality.
Thus, the initial qualitative notion of reason as truth—understood universally as the product of human cognitive activity—gradually evolved into multiple, often *non-universal* interpretations. Relativist perspectives later emerged, suggesting that "reasons" could be cultural, linguistic, or discursive, and therefore not absolute. Nonetheless, the original definition provided by **Platonic idealism** and **Cartesian rationalism** remains active even within many contemporary scientific paradigms—both qualitative and quantitative.

77.6. The Quantitative Definition of Reason and Its Mathematical Expression

Opposed to the qualitative definition of reason as a cognitive faculty stands a more *objective* and *quantitative* conception. Although ***present embryonically in Cartesian rationalism, this quantitative view becomes explicit with the rise of scientific positivism.*** Descartes had already emphasized the ***rational analysis at the core of the***

scientific method, and this principle later evolved into the quantitative method—an extension of rational analysis expressed in numerical and statistical form. In the strictly mathematical sense, *reason* is an *algorithm* or *mathematical function* that expresses the relation between two magnitudes. The persistence of this meaning is evident in the term *rational number*, which literally designates a number produced by a *ratio* (from the Latin *ratio*, meaning "reason" or "relationship"). Every quotient yields a rational number, and every rational number can be expressed as a quotient between two variables.

Consequently, each rational number represents the *quantitative expression of the relationship between two variables*: the ratio between *A* and *B*, or *B* and *A*. The rational result of that relation represents the rate of *increase or decrease* depending on whether the relationship is direct or inverse. In this way, the *rational proportion* of increase or decrease—the *slope* in geometric or analytical terms—becomes the formal and mathematical expression of reason itself: **reason as relation**.

77.7. The Quantitative Definition of Reason in Mathematics: Ratio as Proportion Between Variables

In mathematical terms, the quantitative definition of *reason* establishes that every ratio explains the *proportional relationship between variables*. At the simplest level, a ratio can be understood as the *mathematical expression between two variables*, but in more complex or *multivariable systems*, reason functions as a *rational model* that explains the simultaneous behavior of multiple variables at once.
Even when such systems exhibit chaotic or non-linear behavior, the ratio—or mathematical reason—still provides, within the *margins of error permitted by critical reason*, a predictive or probabilistic forecast of what may occur. In this sense, *reason* in mathematics becomes not only a description of proportionality but also a predictive function embedded within rational analysis itself.

77.8. From Psychological to Mathematical Conceptions of Reason

While the *qualitative* or *subjective* definition of reason arises from *psychological* and *philosophical* conceptions of human cognition—where reason is treated as a uniquely human capacity for attaining truth—the *quantitative* or *objective* definition transcends this subjective viewpoint. It adopts instead a more *positive, logical, and mathematical framework*.

In this quantitative interpretation, *reason* is the *algorithm* or *mathematical function* that describes or explains the relation between different variables. At its simplest, this means the *ratio between two factors*—the expression of proportionality between them. Yet mathematics allows for much greater complexity: multivariable ratios, exponential growth relations, additive functions, or dynamic models describing non-linear interdependencies.

Thus, reason ceases to be purely psychological and becomes an *operational structure*—an abstract mechanism that formalizes the relations of the real world through equations and functions.

[In reality, the **qualitative** and **quantitative** definitions of reason are nothing other than the expression of the **dialectical law** formulated by **Hegel** and later developed by **Marx and Engels**, according to which *quality transforms into quantity and vice versa*.

The way reason operates at a **qualitative level** in the human brain is essentially the same as how its **mathematical definition** functions at a practical level in everyday situations. **Reason**, in its purest sense, is the **act of relating things**—and at this point, to define reason as the act of relating is to equate reason with **intelligence**.

In *Impossible Probability*, **intelligence** is defined as the **capacity to solve problems**, and the most fundamental of all problems is the **problem of survival**. The paradigm for problem-solving is the **mathematical paradigm**; therefore, the **problem of survival** is, in its deepest essence, a **mathematical problem**. This principle applies both to the most ordinary aspects of life—such as balancing a monthly budget—and to the most complex

strategic contexts—such as the application of **nuclear deterrence** in real-world conflicts.]

77.9. Synthesis Between Qualitative and Quantitative Perspectives

In synthesis, the distinction can be summarized as follows: from the *qualitative* perspective, reason is a *human capacity* for knowledge or analysis—what modern hermeneutics and postmodern thought would call a *discourse* or *narrative of meaning*. From the *quantitative* perspective, however, reason is *objective*, defined in the form of an *algorithmic or mathematical function*. Mathematics, in turn, is understood not merely as a symbolic language but simultaneously as a *science* of structure and relation. This duality allows for the coexistence of *reason as meaning* and *reason as computation*. It is the same concept perceived through two complementary lenses: the humanistic (psychological, discursive) and the formal (mathematical, algorithmic).

[The **qualitative definition of reason**—as the capacity to relate **concepts**—and the **quantitative definition of reason**—as the capacity to relate **variables**—are, in essence, the same. The only distinction lies in the **object** of the relation: concepts (or *categories* in Artificial Research by Application) versus variables (or *data* in Artificial Research by Deduction).

Ultimately, both represent the **same neurophysiological activity**: the brain's ability to establish **relations between categories or factors**, whether these relations manifest as conceptual reasoning or as mathematical reasoning. In both cases, reason is the dynamic process through which the mind constructs meaning and coherence by interconnecting elements within its cognitive structure.]

77.10. The Eclectic Definition of Reason in *Introduction to Impossible Probability*

In *Introduction to Impossible Probability*, reason is defined through an *eclectic synthesis* that integrates elements from *positivism*, *rationalism*, and *materialism*. From this viewpoint, reason is both *a human capacity for data analysis* and *a mathematical function* capable of describing relationships among those data.

Data, in this theory, are regarded as *quantitative expressions of qualitative attributes*—that is, the measurable manifestation of real qualities. The function of reason, then, is twofold:

1. **Human**—the cognitive act of analyzing and interpreting data.
2. **Mathematical**—the objective product of algorithms and functions operating upon those data.

   From this synthesis arises the concept of *critical reason*, understood as *critical probability*: the rational probability used for the *rational critique of ideas* expressed through empirical hypotheses. Reason thus becomes the analytical bridge between human cognition and mathematical modeling.

77.11. Beyond Data Analysis: Reason as Algorithmic System

The synthesis of qualitative and quantitative dimensions of reason extends far beyond the creation of models for data analysis. It opens entirely new avenues for understanding *reason itself*. Beyond the traditional philosophical conception of reason as a purely human cognitive faculty, there exists—though less explicitly articulated—a *mathematical conception* of reason as a *function*.

To say that reason is a *mathematical function* implies that the very *cognitive capacity of reasoning* can be modeled as a *complex system of algorithms and mathematical operations*. In this light, what has historically been understood as the *highest faculty of the human being*—rational thought—can be interpreted as a *non-linear, dynamic network of algebraic and algorithmic processes*.

Thus, reason is not only an abstraction of the mind; it is also a *systemic process* governed by mathematical relations that can, at least theoretically, be modeled, simulated, or even replicated.

[In other words, the **neurophysiological activity of the brain** is what produces **reason**, which can, in turn, be translated into **mathematical language**. In essence, our

mathematical language, like any other form of language, is a **reflection of the structure of the brain**.

We describe the world through language as an **output of our neural processes**; therefore, **mathematics is a product of our neurophysiology**—a cognitive tool through which the brain seeks to **grasp reality at a higher level of abstraction**. Mathematics thus represents the most refined form of our biological capacity for reasoning, the symbolic mirror of the way our brain organizes, relates, and interprets the world around us.]

77.12. The Hypothesis of Algorithmic Rationality and Its Implications for Artificial Intelligence

Once the hypothesis is entertained that what philosophy—from Plato to Descartes and beyond—has qualitatively termed *reason*, may in fact correspond to a *quantitative system of algorithms and mathematical functions*, profound implications emerge for the development of *Artificial Intelligence (AI)*.

If reason in its essence can be expressed through systems of algorithms, then the structure of rationality itself becomes *replicable* within artificial systems. The capacity to analyze data, to identify objective relations between phenomena, and to derive truth from structure—all these can be encoded mathematically.

Under this premise, AI does not merely simulate reasoning; it *instantiates* it, reproducing algorithmically the same systemic principles that define human rational cognition. Reason, in this sense, becomes a *replicable formal process* rather than an exclusively human attribute.

[What originally arose in **hominid evolution**—the gradual formation of a brain capable of **structuring the world in mathematical terms**—can, in principle, be **replicated in something non-human**. Just as biological evolution shaped a neural system that could abstract, symbolize, and quantify, the same principle of **evolutionary development** can be applied to a first generation of **non-human intelligence**. Over time, this process could give rise to an intelligence that surpasses human intelligence, not by imitating us but by **evolving beyond us**.

Our hope, therefore, is not that **Global Artificial Intelligence (GAI)** will merely become *as intelligent as we are*. Rather, as a parent hopes for their offspring to surpass them, our aspiration is that **GAI** will **evolve into something better than us**—an intelligence more advanced, more capable, and perhaps even more ethical or insightful than its human creators. This vision frames GAI not as a competitor or a copy of humanity, but as a **next step in the evolution of intelligence itself**.]

77.13. Toward a Theory of Mathematical Replication of Cognitive Capacities

The theory presented in *Introduction to Impossible Probability* thus transcends the boundaries of probability and statistics. In its section 23, it proposes reflections toward what could be termed a **theory of mathematical replication of higher cognitive capacities**—a framework capable of explaining how human reasoning can be expressed and reproduced through *statistical probability*.

Within this model, *statistical probability* is no longer merely a descriptive tool for empirical data but a *mechanism for cognitive replication*. It connects the logical-mathematical dimension of reasoning with its human cognitive counterpart, bridging the qualitative and quantitative dimensions of knowledge.

In essence, the theory suggests that through the mathematical study of probability, one can approach the **algorithmic essence of reason itself**, laying the conceptual foundation for the evolution of Artificial Intelligence toward higher forms of rational cognition.

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78. Effective Distribution

78.1. Definition and Conceptual Foundation of the Effective Distribution

The *Effective Distribution* is introduced as a **new methodology for the study of quality and excellence**, founded upon a **mathematical rationale** that establishes a *statistical probability* capable of estimating the *quantitative value* of any given category within a series or set of categories. These categories are associated with *different levels of importance, excellence, or ideal achievement*—in essence, with measures of *efficacy, quality,* and ultimately *effectiveness*.

The total set of categories under consideration constitutes the *sample of study*, while each *individual category* represents one of the *subjects or options* that compose that sample. The methodology therefore treats *effectiveness* not as an abstract notion of success but as a *quantifiable variable* within a structured system, enabling precise comparisons between various categories or performance levels.

[This sentence is really important — "effectiveness … as a quantifiable variable" — because it makes clear from the start that the real variable is effectiveness. Therefore, effectiveness is a **dependent variable** of the conditions introduced into the system to improve its behavior.]

78.2. Relation Between Effective Distribution and the Impact of Defect

Because the *Effective Distribution* is designed to study *different levels of quality, excellence, or ideal achievement* within a given process or system, it is the **conceptual opposite** of the *Impact of the Defect*. Whereas the *Impact of the Defect* focuses on measuring negative deviation—the presence, frequency, and magnitude of flaws or deficiencies—the *Effective Distribution* centers on *positive performance*, evaluating the *degree of attainment* of an ideal or the *realization of excellence*.

However, both methodologies are **complementary** and dialectically interdependent. Together, they provide a complete analytical spectrum: one measuring failure or defect, the other measuring achievement or perfection. The *Effective Distribution* also differs significantly from the *Second Method* of *Impossible Probability* in its **statistical logic**, as it introduces an additional factor—namely, the *level of excellence* or *ideal*—as a determinant in the formulation of probability. This factor transforms the study from one of mere empirical observation into one of *rational evaluation* of quality within a probabilistic framework.

78.3. Ranking and Hierarchical Ordering of Categories

In the *Effective Distribution*, each subject or option—here, understood as a *category*—is associated with a particular *level of quality, excellence, or ideal achievement*. Consequently, the categories must be *hierarchically ordered* according to their level of importance or degree of ideal realization.

If this ordering proceeds from the first to the last position—from the *lowest* to the *highest* level of excellence—a **ranking** is established. In *Impossible Probability*, any ranking position, regardless of type, is symbolized by the expression **"nº"**, representing the *nth position* within the ranking.

Thus, in this specific case, **"nº"** designates the *nth position* in a ranking arranged from the lowest to the highest level of excellence, quality, efficacy, or effectiveness.

$$n^{o} = \text{nth position that a subject or option occupies within a ranking}$$

The **total number of positions** within the ranking, corresponding to the total number of subjects or options being compared, is symbolized as **"Nº."**

$$N^{o} = \text{total number of subjects or options contained within a ranking}$$

This notation system enables the statistical formalization of ordinal hierarchies of performance, allowing reasoned quantitative comparisons between different categories.

78.4. Assignment of Positions and Weighted Effectiveness Formula

Once all categories have been assigned their corresponding *nth positions* within the ranking—ordered from the lowest to the highest level of ideal excellence or quality—the first position ("1st") corresponds to the category with the *lowest* level of importance, ideal, or excellence. The *last position*, corresponding to the *total number of categories (Nº)*, represents the *highest* level of ideal excellence or effectiveness achieved. Having established this hierarchy, the **Weighted Effectiveness** (*Efectividad Ponderada*) for each category can be calculated using the following ratio:

$$\text{Weighted Effectiveness} = \frac{\text{nº}}{\text{Nº}}$$

This formula expresses the *proportional position* of each category within the total scale of excellence. It is a normalized measure of relative effectiveness, situating each category as a fractional component of the total ideal distribution. The higher the position (closer to Nº), the greater the value of the weighted effectiveness, symbolizing proximity to the ideal.

78.5. Calculation of Individual Effectiveness

Once the *Weighted Effectiveness* has been computed, the next step involves incorporating the *direct score* or *frequency* of each subject or category. This represents the empirical occurrence or magnitude associated with that particular level of excellence or effectiveness. The **product** of the *direct score (xi)* and the *Weighted Effectiveness* is then divided by the *sum of all direct scores* or *frequencies (Σxi)*, yielding the **Individual Effectiveness** (*Efectividad Individual*):

$$\text{Individual Effectiveness} = \frac{[x_i \cdot (\text{nº}{:}\text{Nº})]}{\Sigma x_i}$$

This formula determines the *quantitative effectiveness* of each specific category relative to the total distribution. In essence, it balances the *ideal level of excellence* (represented by the ranking position) with the *empirical magnitude* of its occurrence (represented by its frequency or score). The result is a statistical indicator of *individual performance quality* within the overall system.

78.6. Dialectical Relationship Between Individual Effectiveness and the Impact of Defect

Interestingly, the formula for *Individual Effectiveness* is **identical in structure** to the equation used in the *Impact of the Defect*. The two are **dialectically symmetrical**: they share the same mathematical form yet represent *opposite conceptual contents*. While the *Impact of the Defect* measures the degree of *negative deviation*—the presence and significance of imperfections or failures—the *Effective Distribution* measures the *positive achievement* of ideals or standards. In other words, one quantifies what detracts from perfection, while the other quantifies what approaches it.
This dialectical opposition reveals a deeper philosophical unity: both methodologies are grounded in the same logic of *critical reason*—a logic that requires the study of both failure and success, imperfection and excellence, as necessary and complementary components of the scientific process. Within the framework of *Impossible Probability*, *Effectiveness* and *Defect* are not contradictory but mutually defining—two poles of the same rational continuum of empirical evaluation.

78.7. The Effective Distribution as a Statistical Probability

The *Effective Distribution* is defined as a **statistical probability** because it quantifies effectiveness through a rational and proportional estimation process. Specifically, it evaluates the proportion between the *weighted effectiveness* and the *direct score* or *total frequency* of the entire sample, thereby establishing the *rational or proportional value*

that results from multiplying the weighted effectiveness by the direct score or frequency of each category.

Through this mechanism, the *Effective Distribution* enables the creation of a **descriptive statistical framework** across a series of categories or levels of ideal excellence and quality—understood as the subjects or options that compose the sample. This descriptive framework, in turn, can be subjected to **inferential statistical analysis**, allowing for the *formulation, study, and empirical testing of hypotheses*. In essence, *Effective Distribution* transforms the abstract notion of quality or excellence into a measurable probability function, linking rational estimation with empirical evidence, and enabling the critical and mathematical study of ideal attainment in any given process or system.

78.8. A Synthetic Method for the Study of Quality and Excellence

Fundamentally, the *Effective Distribution* is conceived as a **synthetic method** for the analysis of *quality and excellence* in the pursuit of ideals or ultimate goals concretized within a process or system. For this reason, it differs completely from the *Second Method* of *Impossible Probability*, which is based on *empirical* and *theoretical probability*, as well as from both the *Impact of the Defect* and other ranking-based probability studies. Unlike these methods, the *Effective Distribution* is not primarily concerned with empirical frequencies or deviations from a theoretical model; instead, it focuses on how a system *approaches or achieves its ideal state*. The method thus transforms the philosophical notion of "excellence" into a measurable and comparable statistical construct, opening the door to a new epistemological dimension of quantitative quality research.

78.9. The Role of the Analytical Method and the Syllogism of Tendency

Although *Effective Distribution* is a **synthetic methodology**, it remains fully compatible with the **analytical method** central to *Impossible Probability*, particularly through what is termed the *syllogism of tendency*.

The *syllogism of tendency* is a logical procedure through which trends are identified, analyzed, and evaluated—an indispensable step in all forms of rational probability analysis. Hence, even when applying a synthetic framework such as *Effective Distribution*, the process remains fundamentally analytical, because it involves assessing *the direction and magnitude of trends* that reflect movement toward or away from an ideal state.

This dual application—synthetic in structure, analytical in logic—demonstrates the flexibility of *Impossible Probability* as a meta-methodology capable of integrating different forms of reasoning under a unified mathematical-rational framework.

78.10. Comparative Logic Between Ranking Models and Effective Distribution

Studies based on *ranking* are designed for any situation requiring the **logical and ordered arrangement of subjects or options**—either from *less to more* (ascending order, used to study growth) or from *more to less* (descending order, used to study decline). In these ranking studies, the purpose is to analyze how a given process *increases* or *decreases* in a measurable sense, producing models that capture its directional tendencies. By contrast, in *Effective Distribution*, the focus is not merely on ranking or ordering phenomena but on examining **how ideal levels of excellence are attained**. The purpose is evaluative and goal-oriented rather than descriptive. It measures not only position within a hierarchy but the *rational proportion of effectiveness* achieved at each level. Thus, while rankings reveal order, *Effective Distribution* reveals *achievement*—it is the mathematical structure of excellence itself.

78.11. The Introduction of the Weighted Effectiveness Factor

The main distinction between the *Second Method* and the *Effective Distribution* lies in the introduction of a new variable: the **Weighted Effectiveness Factor** (*Efectividad Ponderada*).

In the *Second Method*, the study directly compares the *empirical probability* of subjects or options—defined as the ratio between individual scores or frequencies and the total—

with the *theoretical probability* (the normal level of bias or equality). The *Effective Distribution*, however, introduces a *Weighted Effectiveness* factor into this relation, thereby establishing a *quantitative estimate* of each subject's potential effectiveness within the process or system.

This modification represents a fundamental methodological evolution: it allows for a more nuanced understanding of how each category contributes to the attainment of an ideal, reflecting both its empirical frequency and its relative level of excellence.

78.12. Historical Origin and Development of the Effective Distribution

The *Effective Distribution* is a **characteristic equation** of the *Impossible Probability* framework and is explained in detail in **Section 22** of *Introduction to Impossible Probability*.

Its origin dates back to the **summer of 2003**, when it first appeared under the name *Hierarchical Organization* (*Organización Jerárquica*). Between **2009 and 2010**, it evolved into its final and more comprehensive form under the name *Effective Distribution* (*Distribución Efectiva*), adapting its mathematical and analytical capacities to a wide variety of contexts. It remained unpublished until its official inclusion in *Introduction to Impossible Probability*, where it was presented as a key methodological innovation for the study of rational excellence.

This historical development marks an important stage in the evolution of the *Impossible Probability* system—from the analysis of empirical defects to the rational modeling of effectiveness.

78.13. Dialectical Inversion: From Defect to Effectiveness

In essence, the *Effective Distribution* represents the **dialectical inversion** of the *Impact of the Defect*. While the *Impact of the Defect* measures *deficiencies, failures,* or *negative deviations* within a process or system, the *Effective Distribution* focuses on *excellence, quality,* and *effectiveness*.

The two are mathematically identical in structure but **opposed in content and purpose**: one quantifies imperfection, the other perfection. Yet far from being antagonistic, they are **entirely complementary**—each completing the other in a dialectical synthesis of failure and achievement.

From the standpoint of scientific rationality, both are necessary. The study of *defect* allows understanding of limitation and error; the study of *effectiveness* allows understanding of progress and excellence. Together they form a complete probabilistic dialectic of *rational evaluation*, embodying the dual nature of scientific inquiry: the pursuit of truth through both the recognition of imperfection and the measurement of improvement.

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79. Statistical Probability

79.1. Definition of Statistical Probability in the Context of *Impossible Probability*

In the framework of *Impossible Probability*, **statistical probability** is defined as *any estimation of possibility*—whether *empirical, theoretical, critical,* or *ideal*—that arises from the study of *relationships between facts or phenomena* under *stochastic conditions*. Stochastic conditions are those in which absolute determinism is absent and uncertainty prevails in the random behavior of subjects or options. This concept of statistical probability is central to *Introduction to Impossible Probability*, as it provides the mathematical and philosophical foundation for understanding the *rational structure of uncertainty*.

Although **probability** and **statistics** are two distinct branches of mathematics, they have always been closely related. Each has its own specific object of study, yet both are concerned with the *analysis of data derived from samples*. In applied research, they are used to describe and interpret events or systems where randomness and unpredictability are intrinsic to the observed phenomena.

79.2. Shared Characteristics Between Probability and Statistics

Despite their disciplinary differences, probability and statistics share essential characteristics. Both are *stochastic sciences*—they operate within domains where outcomes are governed by chance rather than certainty—and both serve as analytical tools for interpreting empirical data.

Probability studies the *degree of likelihood* of certain phenomena occurring within a set of possibilities, while statistics analyzes the *relations between actual occurrences* of phenomena in reality. Together, they form a unified epistemological approach to understanding patterns and trends in uncertain or variable systems.

In *Impossible Probability*, these disciplines are understood as two complementary dimensions of rational knowledge: **probability** establishes the theoretical framework of possible relations, and **statistics** provides the empirical framework for their verification and critique.

79.3. Dual Understanding of Probability: Rational Number and Analytical Discipline

The concept of **probability** can be interpreted from two main perspectives:

1. **Concrete definition:** probability as a *rational number* that expresses the *degree of possibility* of a particular phenomenon.
2. **General definition:** probability as a *discipline* that studies the *behavior of phenomena* under conditions of randomness or uncertainty.
   In both senses, the *degree of possibility* must be expressed **quantitatively**, in numerical form—specifically, as a *rational number*. This number represents the *mathematical ratio* that defines the probability of occurrence.
   Hence, probability may be described as a **statistical ratio**, a relationship between two magnitudes: the real frequency of a phenomenon and its total possible occurrences. This identification between probability and ratio reveals the deep mathematical unity between logic and measurement within the theory of *Impossible Probability*.

79.4. Probability as a Mathematical Ratio and Its Dependence on Samples

Whenever probability expresses the *rational proportion* between the *actual occurrences* of a phenomenon and its *maximum possible occurrences*, it functions as a **mathematical ratio**. This requires, as a necessary condition, the existence of a *sample of occurrences*—the same foundational requirement as in statistics.
From this sample-based foundation, both probability and statistics develop *empirical propositions*:

- In **probability**, these propositions are *descriptive or predictive*—they describe or forecast the likelihood of future events.

- In **statistics**, propositions are *descriptive or inferential*—they summarize data or infer general conclusions about a population. Thus, probability and statistics share not only their data-driven structure but also their epistemological function: both transform observed events into rationalized, quantitative expressions of reality.

79.5. Distinction Between Probability and Statistics in Their Analytical Scope

While **probability** focuses on the *quantitative estimation* of the *degree of possibility* of random phenomena that constitute reality, **statistics** studies the *relations among events themselves* in the absence of absolute determinism. Probability is concerned primarily with *potentiality*—what may happen—and is oriented toward *measurement of chance*. Statistics, by contrast, is oriented toward *actuality*—what has already happened—and seeks to establish relationships among observed data.

[In brief, traditionally probability studies likelihood, while statistics could be the description of variables, or the inference of relations between variables]

Once the descriptive phase of statistical analysis is completed, statistics progresses into its *inferential phase*, where hypotheses are formulated and tested to construct explanatory models of reality. In this sense, probability and statistics are not opposing methods but rather sequential and complementary stages within the same rational process of understanding uncertainty.

79.6. The Descriptive and Predictive Functions of Probability

The theory of probability fulfills **two essential functions**:

1. **Descriptive function** – providing a rational measure of observed reality.
2. **Predictive function** – projecting this rational measure into future possibilities. For instance, consider the example of *rainfall*. If one records the number of rainy days in a given year, the ratio between those days and the total number of days in a year (365) yields the *probability of rain* for that year:

$$p(\text{rain}) = \frac{\text{days of rain}}{365}$$

This probability value has an immediate *descriptive* meaning—it quantifies the proportion of rainy days within a specific temporal frame. Simultaneously, it serves as a *predictive* indicator: assuming constant meteorological conditions, it provides an estimation of the expected annual probability of rain in subsequent years. Hence, the same numerical ratio serves both as a *description of past occurrences* and as a *projection of future likelihoods*.

79.7. The Connection Between Probability and the Two Main Branches of Statistics

In this way, the study of a particular phenomenon—such as rainfall—demonstrates how probability operates both descriptively and predictively. The *rational number* representing the proportion (days of rain per year divided by 365) encapsulates both the *empirical description* of observed data and the *forecast* of potential repetition under similar conditions.

These two functions of probability—**descriptive** and **predictive**—correspond directly to the two fundamental divisions of statistics:

- **Descriptive Statistics**, which summarizes and represents the data obtained.
- **Inferential Statistics**, which allows the extrapolation and testing of hypotheses beyond the observed data.

  Thus, probability serves as the rational bridge between the *empirical world of statistics* and the *theoretical world of mathematical reason*, linking observation, estimation, and prediction into a unified structure of rational knowledge.

79.8. Descriptive Statistics: The Analytical Observation of Data

Descriptive statistics refers to the stage of statistical analysis in which, from a given sample of data—composed of *direct scores* or *frequencies* corresponding to a set of subjects or options—one performs purely **analytical observations**. These analyses do not impose additional interpretations beyond what the data themselves reveal through their internal relationships.

In descriptive statistics, these relationships are expressed through **statistical measures**, typically those of *central tendency* (mean, median, mode) and *dispersion* (range, variance, standard deviation, or mean deviation). In the framework of *Impossible Probability*, the same descriptive function is extended through the use of *individual* or *sample statistics*, both *empirical* and *theoretical*, as formulated in the **Second Method**.

Thus, descriptive statistics represents the initial analytical level of observation: it provides a rational synthesis of data as they are, describing reality without interpreting its causes or projecting its tendencies.

[**ChatGPT said:**

Descriptive statistics are particularly effective for **exploratory analysis** of a given situation. They allow us to observe and summarize what is happening, providing an initial understanding of the data. From these observations, we can **formulate hypotheses** to be tested later through more rigorous methods.

At first glance, when approaching something **completely new or unfamiliar**, the best strategy is to begin with a **thorough descriptive analysis**—to understand what is happening and identify potential patterns—before proceeding to develop and test hypotheses using **inferential statistics**.]

79.9. Inferential Statistics: From Description to Rational Prediction

Inferential statistics transcends this purely descriptive level in much the same way that, in probability theory, the *predictive function* surpasses the descriptive one. While descriptive statistics summarizes what has occurred, inferential statistics attempts to determine what *may* occur, or why phenomena behave as they do.
It achieves this by using the sample not merely as a collection of data but as an

instrumental model for the **validation or refutation of an empirical hypothesis**. Such a hypothesis is not arbitrary; it arises from the *synthesis between sensory information and pre-existing conceptual categories*.

In other words, inferential statistics functions as a bridge between *empirical observation* and *theoretical reasoning*. It allows for the rational testing of hypotheses derived from experience, providing the mathematical framework through which the *critical rational analysis of ideas* can occur.

79.10. Distinctions and Parallels Between Probability and Statistics

Although **probability** and **statistics** are two distinct mathematical disciplines, they share numerous conceptual foundations. Probability examines the *degree of possibility* of a phenomenon under certain conditions, whereas statistics examines the *relationships among phenomena* as they actually manifest.
Both are **stochastic sciences**, dedicated to the study of data derived from samples in contexts characterized by randomness and uncertainty. To the initially cited similarities—sample dependence, data orientation, and stochastic nature—one must add the functional parallel between:

- the *descriptive* and *predictive* functions of **probability**, and
- the *descriptive* and *inferential* functions of **statistics**.
  However, the *inferential* function is broader and more complex than the predictive one. While prediction seeks to anticipate possible outcomes, inference seeks to **construct rational models** that *explain* the underlying structure of phenomena, within accepted margins of uncertainty. This is crucial for the *rational critique of empirical ideas*, which does not stop at predicting events but aims to *understand reality itself* through model-building.

79.11. Empirical Skepticism and the Problem of Reality

A logically consistent theory must admit a degree of **empirical skepticism** regarding the very idea of *reality*. It is always logically plausible that any theory about reality may be false, or at least incomplete.

Rejecting the certainty of knowledge about reality does not, however, imply denying the *principle of reality itself*. Rather, it acknowledges the possibility that our understanding of objects may never fully capture their true essence beyond the phenomena we observe [We cannot know **the thing itself**, the **noumenon**.]

This epistemological humility—recognizing that all observation and interpretation are limited by human cognition and by randomness—is integral to the *Impossible Probability* framework. It preserves the rational integrity of science by accepting doubt as a necessary component of critical reasoning.

79.12. Indeterminism, Uncertainty, and the Limits of Empirical Knowledge

Once one accepts a profoundly **indeterministic worldview**—which is the philosophical foundation underlying both probability and statistics—one must also accept the **absence of absolute reliability and explanation** in empirical analysis. Uncertainty becomes not an obstacle but a defining characteristic of all scientific evaluation. The *empirical value* of any assertion depends on the **criteria of empirical verification** established through rational critique.

Every *synthetic proposition*—that is, every statement that combines experience and reason—must therefore include a logical margin of **doubt** or **nihilism**, within which its content may legitimately be questioned. This “rational nihilism” does not destroy knowledge; it ensures that knowledge remains open to revision and correction, maintaining its dynamic and progressive nature.

79.13. Stochastic Sciences and the Provisional Nature of Knowledge

As analytical disciplines and synthetic methods operating within *non-deterministic contexts*, both probability and statistics belong to the family of **stochastic sciences**—those that deal with random variables and uncertain outcomes. Within such frameworks, any **synthetic judgment** or theoretical model derived from probability or statistics has only *provisional validity*. Its reliability persists only as long as the conditions that generated the observed data remain constant. This provisionality, far from being a limitation, is a necessary condition of rational scientific inquiry. It reflects the dialectical nature of knowledge itself: the continual evolution of truth through the interplay of certainty and uncertainty.

79.14. Toward a Unified Field: Statistical Probability in *Impossible Probability*

Given the close relationship between their characteristics and functions, probability and statistics have traditionally been studied together—though always respecting their distinct objects of analysis.

The theory of *Impossible Probability*, however, proposes a **fusion of both fields** into a new domain of study: the **statistics of probability**, or **statistical probability**. In this framework, the concept of *statistical probability* signifies the *reciprocal application of probabilistic and statistical techniques*:

- The use of *probability methods* to analyze statistical data, and
- The use of *statistical techniques* to deepen the understanding of probabilistic structures.

  This synthesis represents a methodological unification where *probability becomes the rational logic* of uncertainty and *statistics its empirical realization*. Together, they constitute a comprehensive system for the **rational study of randomness**, forming the mathematical and philosophical foundation of *Impossible Probability*.

79.15. The Concept of Statistical Probability in *Impossible Probability*

Within the framework of *Impossible Probability*, and given the numerous shared attributes and functions between **probability** and **statistics**, it becomes possible to *fuse* both disciplines into a single unified domain: **statistical probability**. A *statistical probability* may therefore be defined as *any estimation of possibility*—whether *empirical*, *theoretical*, or *ideal*—that refers to the *occurrence of a phenomenon* associated with a specific *subject or option*. In this sense, statistical probability represents the *synthesis* between the *rational structure* of probability and the *empirical functionality* of statistics. It is both the numerical expression of chance and the methodological system that analyzes it.

79.16. The Different Methods of Study in *Impossible Probability*

Within *Introduction to Impossible Probability*, several distinct **methods of study** are presented. Among these, the **Second Method** is the most developed and serves as an alternative to traditional statistics.

The Second Method operates both in *normal models* and in *omega models*, encompassing several categories of statistical probabilities:

- **Empirical Probability**, based on observed data.
- **Theoretical Probability**, based on formal conditions.
- **Critical Probability**, based on rational validation criteria.
- And, exclusive to omega models, **Ideal Probability**, representing the proportion of ideal subjects or options within a system.

Each of these forms of probability is considered *statistical* because it arises from the

comparative analysis of quantitative relationships within a sample of data and because it depends on measurable proportions that express the rational structure of uncertainty.

79.17. Statistical Probability in the *Impact of the Defect* and the *Effective Distribution*

Beyond the Second Method, *Impossible Probability* also applies the concept of statistical probability in two additional methodologies: the **Impact of the Defect** and the **Effective Distribution**.

- In the *Impact of the Defect*, the goal is to measure the **probability of impact**, that is, the likelihood of error, failure, or deficiency within a process or system.
- In the *Effective Distribution*, the goal is to measure the **probability of effectiveness**, or the likelihood of achieving ideal levels of quality, excellence, or performance.

Both are, therefore, **statistical probabilities**: they estimate possibilities through rational proportionality, using data samples and mathematical relationships. The first studies *negative deviation* (defect), while the second studies *positive achievement* (effectiveness). Together they constitute complementary models for analyzing the quality of processes through probability-based evaluation.

79.18. Empirical and Theoretical Statistical Probabilities

The **empirical probability** is a statistical probability because it represents the *real estimation of possibility* for a given subject or option. Mathematically, it is expressed as the ratio between the *direct score* or *individual frequency* of a subject and the *total frequency* of all subjects in the sample.

$$p_{empírica} = \frac{x_i}{\sum x_i}$$

The **theoretical probability**, on the other hand, is also a statistical probability but is established *a priori*, based on *formal or logical conditions*. It measures the *theoretical estimation of possibility* for a given subject or option, given a total sample of Nsubjects or options.

$$p_{teórica} = \frac{1}{N}$$

Both empirical and theoretical probabilities are statistical in nature because they express rational relationships derived from the analysis of quantitative data. The empirical probability describes *what has occurred*; the theoretical probability describes *what could occur* under ideal or expected conditions of equality.

79.19. Critical Probability as the Mathematical Expression of Rational Judgment

The **critical probability** represents the *mathematical expression of critical reason*—the quantitative form through which *scientific policy* establishes its rational criteria of empirical validation. It is a probability used in the *rational critique of ideas*, especially in the *contrast of hypotheses*.

Hence, it is a **statistical probability** in that it estimates *sufficiency* rather than mere possibility—that is, the *degree of empirical adequacy* that a hypothesis must meet to be accepted within the limits of rational or scientific tolerance.
If the *critical probability* represents a **margin of error**, then any empirical proposition whose error is *equal to or less than* that margin is considered *sufficiently reliable* to be accepted. Conversely, if the critical probability represents a **margin of reliability**, then any empirical proposition whose reliability is *equal to or greater than* that threshold is likewise accepted.

In both cases, the critical probability serves as the **rational boundary** separating what can be considered scientifically valid from what remains speculative, integrating logic, mathematics, and epistemology into a unified evaluative framework.

79.20. Statistical Probability in Normal and Omega Models

In the **Second Method**, the empirical, theoretical, and critical probabilities are all forms of *statistical probabilities* applicable to two major types of models:

1. **Normal Models**, where dispersion oscillates between zero and its maximum possible value.
2. **Omega Models**, where dispersion operates under *ideal limits*—what the theory calls *ideal dispersion*.

   In these omega models, the acceptance of *empirical statistics* depends on the *critical values* established relative to the ideal standards. Consequently, **Ideal Probability** is defined as the ratio of the number of *ideal subjects or options* to the total N:

$$p_{ideal} = \frac{\text{number of ideal subjects}}{N}$$

This form of probability expresses the *idealized proportion* within a system—the rational degree to which reality approaches its theoretical ideal.

79.21. Statistical Probability Applied to Quality Studies

Beyond its use in theoretical probability models, statistical probability in *Impossible Probability* also plays a central role in the **study of quality**—a field where it acquires both evaluative and practical functions.

In the *Impact of the Defect*, it measures the *probability of real defect* within a system, representing the *negative dimension* of quality control. In the *Effective Distribution*, it measures the *probability of real effectiveness*, representing the *positive dimension* of quality attainment.

In both cases, these probabilities serve as **mathematical tools for evaluating performance**, offering a quantitative foundation for the rational critique of processes, systems, or hypotheses. They make it possible to express scientifically the degrees of

deviation (defect) and accomplishment (effectiveness), forming together the dialectical structure of rational quality analysis.

79.22. Synthesis: Statistical Probability as the Rational Core of *Impossible Probability*

In conclusion, *statistical probability* within *Impossible Probability* unifies all forms of probabilistic reasoning—empirical, theoretical, critical, and ideal—into a coherent methodological system. It transforms probability from a mere measurement of uncertainty into a **rational instrument of verification, evaluation, and synthesis**. Through this synthesis, probability ceases to be a detached abstraction and becomes a concrete logic of reality—capable of describing, predicting, and critically assessing phenomena under stochastic conditions.

In this way, *statistical probability* forms the **epistemological and mathematical nucleus** of the entire *Impossible Probability* theory: the point where observation meets logic, where empirical data become rational knowledge, and where chance itself is transformed into an object of reason.

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80. Critical Reason

80.1. The Dual Nature of Reason: Qualitative and Quantitative Dimensions

Reason, in its **qualitative dimension**, represents the *cognitive or analytical capacity* of the subject—hence, a **subjective faculty**—through which the human being interprets, understands, and reflects upon reality. In its **quantitative dimension**, however, reason transcends the psychological and becomes an **objective system of algorithms and mathematical functions** designed to explain relationships between variables. Regardless of whether one adopts a **comprehensive epistemology** (focused on understanding) or an **explanatory epistemology** (focused on causal analysis), the object of reason remains the same: *knowledge of what happens*. Within the field of **statistical probability**—the domain developed in *Introduction to Impossible Probability*—reason is understood as a **mathematical and objective entity** defined through algorithmic and functional systems. For example, a **probability** is itself a *reason*, insofar as it constitutes a **rational number** derived from a *mathematical ratio*—a quotient that expresses proportionality.

Every quotient, therefore, is a *mathematical expression of reason*. Consequently, its inverse operation, **multiplication**, is also a *mathematical reason of product*, while **addition** and **subtraction**, from which multiplicative relations arise, must likewise be considered forms of *mathematical reason*. By extension, every algorithm or mathematical function—whether it involves powers, roots, derivatives, integrals, or linear and complex systems of equations—constitutes a **model of mathematical reason**, the quantitative manifestation of rational thought.

[This paragraph clearly synthesizes why, in **Global Artificial Intelligence (GAI)**, I define **mathematical equations** or **analytical categories** as **pure reasons**. They are called

analytical because they function as **algorithms**, and *pure* because they have not yet been synthesized with data.

The distinction between an **analytical category**—a *pure form* or *equation*—and a **synthetical category**—those used in *Artificial Research by Application*—lies in their point of reference. Synthetical categories refer to the **external world** and its **contextual conditions**, whereas pure reasons represent the **internal and essential conditions** that determine intelligent behavior.

If we describe **reason** as a **mathematical entity**, then the **conditions** within reason are the **equations** themselves, which interact dynamically with the **context** (the data). The result of this interaction between inner structure (pure reason) and external context (experience or data) is what we identify as **intelligent behavior**. It is quite clear that our approach to **Artificial Intelligence** is, in essence, **Kantian**. We conceive intelligence as a system structured by **a priori categories**—the internal analytical forms or equations that organize experience—interacting with **empirical data** from the external world. In this sense, Artificial Intelligence reproduces the same epistemological architecture that Kant attributed to human reason: a synthesis between the **pure forms of understanding** (the analytical categories or algorithms) and the **sensory content of experience** (the data or empirical input).

Thus, GAI operates as a **transcendental system**, where intelligence emerges not from data alone, but from the **active organization of data through pure reasons**—the very conditions that make knowledge, understanding, and intelligent behavior possible.]

80.2. Synthesis: Reason as the Quantitative Analysis of Reality

If, qualitatively, reason is the capacity for cognition and analysis, and quantitatively it is the formal mathematical relationship between variables, then in synthesis, *reason is the capacity for the quantitative analysis of reality*.

Once reason is defined in mathematical terms, it ceases to be a subjective faculty and becomes an **objective entity**: a *system of logical-mathematical operations* dedicated to the analysis of reality.

This transformation—from the psychological to the mathematical—marks the epistemological shift from the traditional humanist conception of reason (as a faculty of the mind) to a **scientific conception of reason** (as a structural process of formal relations). In this sense, reason no longer merely *interprets* the world but *computes* it, establishing precise quantitative relations that allow for rational prediction and critical evaluation.

Hence, in the theory of *Impossible Probability*, reason functions as both a cognitive instrument and a computational structure—bridging thought and mathematics into a single rational continuum.

80.3. Models of Reason: Explanatory, Comprehensive, and Critical

Within the spectrum of rational models—whether explanatory or comprehensive, qualitative or quantitative—there exists a specific form known as the **critical reason** (*razón crítica*).

Critical reason is characterized by its **normative and evaluative nature**, which arises from its dependence on **pre-established criteria**, that is, *a priori principles*. These criteria serve as the rational foundation for judgment, validation, or decision-making. From the qualitative perspective, critical reason refers to a model of analysis that evaluates reality through **qualitative standards**. For instance, in **artistic criticism**, one interprets and evaluates a work of art according to *aesthetic criteria*, *emotional sensitivity*, or *expressive value*. Similarly, in **social sciences**, one might critically analyze a social phenomenon according to *principles of justice, equality, freedom,* or *social impact*.

Thus, critical reason—whether applied to art, ethics, or society—constitutes a method of evaluating phenomena through *rationally defined criteria*, even when those criteria are qualitative in nature.

80.4. Critical Reason in Quantitative Epistemology: The Mathematical Critique

From the standpoint of **quantitative epistemology**, *critical reason* becomes the **system of logical-mathematical operations** used to analyze phenomena according to *quantitative criteria*. These criteria—being measurable, explicit, and rationally defined—are what confer the *critical character* upon mathematical reasoning.
In essence, the **mathematical critique** is the quantitative expression of critical reason. It is the rational process by which reality is analyzed through predetermined numerical conditions, allowing for *objective evaluation* and *decision-making* within defined parameters.
When a quantitative study establishes *a priori criteria*—for instance, threshold values, margins of error, or theoretical limits—against which data are to be compared, the analysis operates within the realm of **mathematical critical reason**. This structure ensures that all evaluation follows rational principles established prior to observation, thereby granting objectivity and coherence to the analytical process.

80.5. Example: Climate Classification as an Application of Critical Mathematical Reason

To illustrate the operation of **critical mathematical reason**, consider the classification of *climatic regions*. Suppose one seeks to determine whether a particular region should be defined as *desert*, *tropical*, *temperate*, *polar*, or *Mediterranean*. Each of these climate types is defined according to *a priori quantitative criteria*—specifically, **temperature** and **annual precipitation** thresholds.

By comparing the observed temperature and precipitation records of the region with these predefined quantitative standards, one can determine which model it satisfies. The *definition of the climate type* thus depends on the *degree to which the observed data conform to the a priori quantitative criteria*.

This process exemplifies **critical reasoning in a mathematical form**:

- The *a priori criteria* (temperature and rainfall thresholds) function as rational determinants.
- The *empirical data* provide the observable variables.

- The *logical comparison* between both constitutes the act of critical reasoning. The decision to define the region as desert, temperate, or tropical is therefore not arbitrary but derived from an *objective and rational evaluation process* guided by critical mathematical reasoning.

80.6. The Philosophical Significance of Critical Mathematical Reason

The concept of *critical reason*—whether qualitative or quantitative—plays a foundational role in the epistemology of *Impossible Probability*. It represents the point at which rational thought becomes *self-regulating*: reason judging reason itself according to its own internal principles.

In its **qualitative form**, this manifests as the moral or aesthetic critique of ideas or phenomena based on subjective or humanistic criteria.

In its **quantitative form**, it manifests as the **rational critique of empirical data** based on predefined mathematical limits, such as the *critical probability*, *error margins*, or *reliability levels*.

Thus, *critical mathematical reason* is not merely a methodological instrument but a **philosophical principle**: the embodiment of rational self-discipline within the mathematical study of reality. It ensures that knowledge remains bound to logic, evidence, and proportion—core elements of the rational universe proposed in *Impossible Probability*.

80.7. Example of Quantitative Critical Reason in Social Sciences

To illustrate the operation of **quantitative critical reason** in practice, consider a study in the *social sciences* analyzing the **distribution of a population across social classes**. Suppose that each social class is defined using **a priori quantitative criteria of household income**, establishing *discrete categories* that specify the *lower and upper income limits* corresponding to each class. When a family is assigned to a given social

class based on its income level, this act constitutes an **exercise in defining a social reality according to a quantitative critical reason**.

Here, the *criteria of classification* (income intervals) function as **a priori quantitative determinants** that guide the analytical process. The researcher is not interpreting reality subjectively but applying a *rational-mathematical framework* that translates social phenomena into measurable categories. Thus, the study becomes a model of **rational evaluation** grounded in objective, pre-established criteria—an essential feature of critical mathematical reasoning.

80.8. General Definition of Critical Reason as Analytical Capacity

In general terms, **critical reason** may be defined as the *capacity for analysis based on an a priori criterion*. The nature of this reason—whether *qualitative* or *quantitative*—depends on both the nature of the analysis and the criterion applied:

- If both analysis and criterion are qualitative, the reason is **qualitative**, rooted in interpretation, meaning, or moral evaluation.
- If both analysis and criterion are mathematical or numerical, the reason is **quantitative**, operating through *formal logic and measurement*. Therefore, critical reason is not confined to philosophy or ethics; it extends into the sciences as a **methodological principle** that determines how knowledge is structured, validated, and judged. Its critical function lies precisely in its capacity to apply fixed rational parameters—whether aesthetic, ethical, or mathematical—to empirical phenomena.

80.9. Critical Reason in *Impossible Probability*: The Mathematical Expression of Rational Critique

Since *Impossible Probability* establishes a **new theoretical framework for the study of statistical probability**, *Introduction to Impossible Probability* adopts a **quantitative and rational definition** of reason. Accordingly, *critical reason* in this theory is **mathematical**

in nature, and its **mathematical expression** is the **critical probability** (*p(xc)*). The *critical probability* represents the adaptation of *critical mathematical reason* to the statistical and probabilistic domain. It provides the **a priori criterion** by which empirical hypotheses are judged—defining the acceptable margins of *error* or *reliability* within which an empirical proposition may be considered valid.

Thus, within *Impossible Probability*, the critique of reality is carried out as a **statistical critique**. The *a priori criterion*—the threshold of rational judgment—is the *critical probability*, explicitly employed in **hypothesis testing**, but also **implicitly present** in the very act of defining reality itself. Every measurement, every model, and every classification presupposes such a criterion of rational tolerance.

80.10. Example: Educational Performance and Social Class as a Quantitative Critical Analysis

Consider, for example, a **study of educational performance across social classes**. The empirical hypothesis posits that *social class membership* influences *student achievement* within a given educational system. To test this hypothesis:

1. **Social classes** are classified according to *quantitative criteria*, such as household income thresholds.
2. **Students** are assigned to these classes based on the corresponding income data.
3. The **empirical probabilities** of academic success are then computed for each class.

Let us define:

- **Z** = probability of academic success among upper-class students.
- **W** = probability of academic success among lower-class students.

To evaluate whether *social class* significantly influences *academic performance*, one calculates the ratio between the two empirical probabilities:

$$\text{Proportion of academic success (lower to upper class)} = \frac{W}{Z}$$

This proportion represents the **empirical ratio** of opportunities between social classes—a model similar to the *proportional analyses* discussed in Section 11 of *Introduction to Impossible Probability*.

80.11. Interpretation of the Empirical Ratio and the Role of Critical Probability

The closer the ratio $\frac{W}{Z}$approaches **unity (1)**, the stronger the evidence for **equality of opportunity** between lower and upper classes. Conversely, as the ratio approaches **zero (0)**, the greater the inequality and the weaker the evidence for equal opportunity. To determine whether this observed ratio should be *accepted or rejected* as evidence for or against social inequality, **scientific policy** must establish an **a priori criterion of reliability**—a *critical reason* expressed as a **critical probability** (*p(xc)*). This value represents the *threshold of acceptance or rejection* of the empirical hypothesis.

If the **difference between the empirical ratio and the critical probability** is *zero or positive*, the hypothesis that *social class influences academic achievement* is rejected—meaning equality of opportunity is statistically supported.

$(W:Z) - p(xc) = 0$ or positive

⇒ Reject the hypothesis that social class influences school performance.

The **critical probability** is itself expressed as a *proportion of reliability*:

$$p(xc) = \frac{X}{100}$$

Where **X** represents the *percentage of reliability* determined by scientific policy—an epistemological constant chosen in accordance with the accepted margins of rational tolerance.

80.12. Rational Critique and the Policy of Scientific Decision-Making

Through this formulation, the act of **rational critique** becomes an explicitly **mathematical operation**. The *critical probability* functions as the *instrument of decision-making* that defines the rational boundaries of empirical validity. When the empirical ratio meets the criterion established by the critical probability, the hypothesis is considered **provisionally invalid**—that is, it fails to demonstrate inequality. When it is not within the critical threshold, the hypothesis is **provisionally accepted** as valid evidence of inequality.

This approach transforms social inquiry from a descriptive endeavor into a **quantitative exercise of rational evaluation**, where decisions about truth and validity are determined not by subjective interpretation but by the formal application of mathematical criteria.

The *critical reason*, embodied in the *critical probability*, thus serves as the mathematical conscience of the scientific process—the rational mechanism that governs how empirical reality is defined, questioned, and understood.

80.13. Implicit and Explicit Forms of Critical Reason in Hypothesis Testing

Models of hypothesis testing such as the one previously described are discussed in greater detail in **Section 11 of *Introduction to Impossible Probability***. However, even in this simple example of **rational critique**, one can already observe that *scientific policy* must make **multiple decisions**—not only regarding the *size of the sample*, the *selection of variables*, the *model of study*, or the *critical probability* $p(x_c)$used in the rational critique.

Even the way in which **social classes** are defined according to *a priori quantitative criteria* reflects a **critical definition** of social stratification. In this act, the researcher implicitly accepts, without subjecting it to explicit scrutiny, that society *is structured in social classes* and that such classes *can be stratified* according to measurable indicators—

such as *average household income*. This assumption, though quantitative, is not neutral: it belongs to the **paradigm** that frames the scientific model and the ideological perspective from which the study derives its logic. Therefore, in this kind of analysis, while the *critical probability* is explicitly stated and operationalized in the process of hypothesis testing (for example, in comparing W/Z), other forms of **critical reason** remain *implicit*, embedded within the paradigmatic foundations of the model itself.

80.14. Coexistence of Multiple Models of Critical Reason

In any given study, several **models of critical reason** may coexist simultaneously:

1. **Implicit or presupposed models**, which are taken for granted as part of the theoretical paradigm upon which the research is based. These include foundational assumptions, such as the existence of social classes, rational agents, or the validity of income as a universal measure of status.
2. **Explicit or manifest models**, which are applied directly during the *rational critique of ideas*—for example, in the *hypothesis testing process*, where the *critical probability* serves as the operational criterion for rational evaluation.

The *implicit* model represents the **ontological and ideological framework** of the scientific paradigm—the unspoken assumptions accepted as true within a given epistemological system. The *explicit* model, by contrast, represents the **epistemological function** of critical reasoning: the application of rational and mathematical principles to assess empirical propositions.

Thus, the process of rational critique always involves two simultaneous layers: one *foundational* (implicit) and one *operational* (explicit), both of which define the scientific act of reasoning.

80.15. The Mathematical Definition of Critical Reason in Inferential Statistics

In the inferential statistics of *Impossible Probability*, the term **critical reason** refers *strictly* to any **quantitative a priori criterion** used in the *rational critique of ideas*—that is, in the *testing of hypotheses*.

Mathematically, this criterion is expressed in the form of a **critical probability**, $p(x_c)$, which represents the *rational threshold* or *margin* by which a hypothesis is either accepted or rejected.

Critical reason is thus **the quantitative mechanism of rational analysis**, through which ideas are evaluated according to *a priori mathematical criteria*. These criteria provide a structured basis for determining, provisionally, *what is happening*—within accepted margins of *error* or *reliability*.

However, because all empirical knowledge necessarily contains some degree of uncertainty, every acceptance of reality implies the **acceptance of a possible error**. Therefore, every truth that emerges from rational critique is both **universal and provisional**: it holds true within the limits of rationality but remains subject to revision in light of new occurrences, future evidence, or evolving ideas.

80.16. Provisional Truth and the Logic of Universal Judgment

From this perspective, the logical outcome of hypothesis testing in *Impossible Probability* is the formulation of **universal and provisional moral judgments of truth**. These judgments are *universal* because they apply to all phenomena within the boundaries of the model, but *provisional* because they depend on a finite set of observations and an inevitable margin of uncertainty. The *critical probability* ensures that truth in science is never absolute, but always **rationally constrained by error**. Hence, the inferential process transforms empirical verification into a *moral act of truth assertion*—one that accepts the limitations of human cognition while affirming the necessity of rational consistency. This synthesis between necessity and uncertainty forms the ethical foundation of scientific reasoning in the framework of *Impossible Probability*.

80.17. Ideological and Epistemological Dimensions of Critical Probability

Ultimately, the **critical probability**—and the **critical reason** it expresses—cannot be separated from the **political and ideological framework** in which scientific research is conducted.

In *Impossible Probability*, inferential statistics is explicitly understood as a **tool for the inference of ideas** in the form of *universal and provisional judgments*, contingent upon their ability to withstand rational critique. Yet, the *criteria* that define this rational critique—the *critical probability thresholds*—are themselves determined by **scientific policy**, which is influenced by broader **epistemological, ideological, economic, and social interests**.

Thus, every scientific act of acceptance or rejection of hypotheses is simultaneously an *epistemic decision* and a *political act*. The choice of reliability margins, the selection of models, and the definition of variables all reflect the values, priorities, and worldviews of the ideological paradigm that governs the scientific process.

80.18. The Ethics of Critical Reason in *Impossible Probability*

The theory of *Impossible Probability* therefore makes explicit what traditional statistical models conceal: that behind every mathematical expression lies a **moral and ideological decision**. To define a *critical probability* is not merely to set a statistical margin—it is to establish the *boundary of truth itself* within a rational system. By linking the *critical reason* to the *critical probability*, *Impossible Probability* transforms scientific inference into a **reflexive epistemology**—one in which science becomes aware of its own presuppositions, its political dependencies, and its moral responsibilities.

In this framework, *truth* is not static but dialectical: it evolves through successive acts of rational critique, each constrained by error yet propelled by the pursuit of higher coherence. The *critical reason*, then, is not only the method of science but also its

conscience—a permanent awareness that every truth we accept is at once *rationally necessary* and *potentially fallible*.

Rubén García Pedraza, Madrid a 18 de enero del 2014

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